



DOT MATRIX LCD MODULE

LCD

PURSuing VISION OF

Over the long course of history, something has continued to provide us with an unchanging sense of progress. That something is the gradual accumulation of refined technology. Stanley is pursuing new LCD that display information with beauty and high visibility-devices that let us express precisely what we wish to say.

The tremendous diversity of our product line meets all of your display needs.

OA devices

Duplicators, Printers, Personal computers, Word Processors

Telecommunication devices

Facsimile machines, Telephones, Radios

Measuring instruments, FA devices

Oscilloscopes, Production control system

Terminal display devices

POS terminals, Cash dispensers, Portable terminals

AV devices

CD players, VCR, Electronic musical instruments

Consumer Products

Cooking instruments, Air conditioners, Remote control units

Others

Vending machines, Medical equipment, Security system, Toys, Optical instruments, Mobile audio system, etc.

CONTENTS

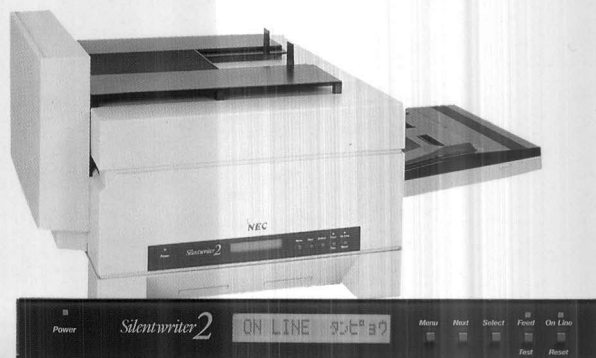
• Product Line	1
• Standard Product List	3
• Available Option List	5
How to read part number	6
LCD type guide	7
Backlighting variation	8
• Character Dot Matrix Modules GMD Series	11
Characteristics	12
Characteristics of control LSI	13
GMD4020E○	17
GMD1610F	19
GMD1620A	21
GMD1640A	23
GMD2020A	25
GMD2040A	27
GMD2420A	29
GMD4020A	31
GMD1640B	33
GMD2020E○	17
GMD1610FL*	20
GMD1620AL*	22
GMD1640AL*	24
GMD2020AL*	26
GMD2040AL*	28
GMD2420AL*	30
GMD4020AL*	32
• Graphic Dot Matrix Modules GMF Series	34
GMF12048BBTW	35
GMF25064ABTW	37
GMF25012ABTW	39
GMF25012EBTW	41
Characteristics of control LSI	43
• Precaution for Usage	44
• Custom Dot Matrix Order Check Sheet	45



Okochi Memorial Technology Prize
 • Stanley LCDs have been developed under the technical guidance of the late Prof. M. Wada of Tohoku University and Prof. T. Uchida (Dr. of Engineering). Stanley GH (guest-host) LCD was awarded in 1986 the 32nd Okochi Memorial Technology Prize.



Multi-color Duplicator



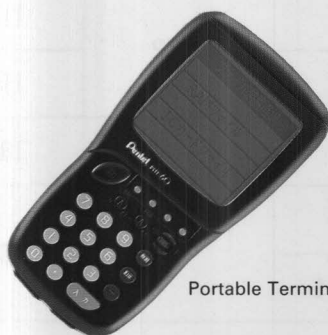
Laser Printer

Note) The symbol which shows the LED backlighting color should be superseded by R, O, AY, Y or G instead of * mark. (See Page 8)
 The symbol which shows the LCD type should be superseded by GTW, BTW, or TW instead of ○ mark. (See Page 17)

THE FUTURE



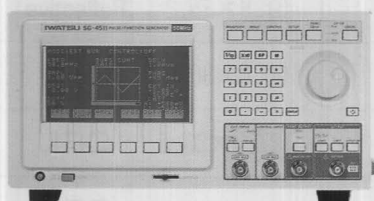
Facsimile machine



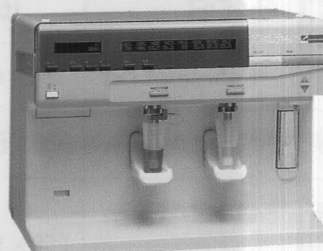
Portable Terminal



Security system



Measuring instruments



Medical equipment



AV amplifier



Electronic musical instrument

Standard Product List

Type	Part No. ※1	Number of Characters or Dots ※3	Module Dimensions ※4 W×D×H ^{MAX} (mm)	Effective Viewing Area W×D (mm)	Back Light Source	Duty Ratio
CHARACTER TYPE GMD Series	GMD1610F	16×1	80×36×10.5	64.5×13.8	Reflective	1/16
	GMD1610FL※		80×36×15		LED	
	GMD1620A	16×2	85×36×10.5	63.5×15.8	Reflective	
	GMD1620AL※		85×36×15		LED	
	GMD1640A	16×4	87×60×10.5	61.8×25.2	Reflective	
	GMD1640AL※		87×60×15		LED	
	GMD2020A	20×2	115×36×10.5	83.0×18.6	Reflective	
	GMD2020AL※		115×36×16		LED	
	GMD2020E○※2				CFL	
	GMD2040A	20×4	98×60×10.5	76.0×25.2	Reflective	
	GMD2040AL※		98×60×15		LED	
	GMD2420A	24×2	118×36×10.5	93.5×15.8	Reflective	
	GMD2420AL※		118×36×15		LED	
	GMD4020A	40×2	182×33.5×10.5	154.5×15.8	Reflective	
	GMD4020AL※		182×33.5×16		LED	
	GMD4020E○※2				CFL	
	GMD1640B	16×4	77×51×11	61.8×25.2	Reflective	
GRAPHIC TYPE GMF Series	GMF12048BBTW	128×48dots	132×60×19	90.0×36.0	CFL	1/64
	GMF25064ABTW	256×64dots	205×58×26	127.5×33.5	CFL	1/64
	GMF25012ABTW	256×128dots	194×96×22	127.5×68.0	CFL	1/128
	GMF25012EBTW				CFL×2	

Note) ※1. The symbol which shows the LED backlighting color should be superseded by R, O, AY, Y or G instead of * mark. (See Page 8)

※2. The symbol which shows the LCD type should be superseded by GTW, BTW, or TW instead of ○ mark. (See Page 17)

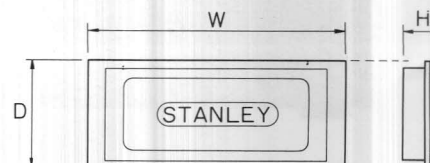
GTW: STN Gray type

BTW: STN Blue type

TW: TN Positive type

※3. Construction of character should be 5×8 dots. (GMD Series)

Note) ※4. Module Dimensions



Character Size W×D (mm)	Dot size W×D (mm)	Temperature Range (°C)		Supply Voltage (V)		Control LSI	LCD Mode	Weight (g)	Page
		Operating	Storage	Logic	LCD				
3.11×5.77	0.59×0.79	0~+50	-20 ~+70	+5	/	HD 44780 or equivalent (Built-in)	TN Positive	25	19
								40	20
3.20×4.85	0.60×0.65							30	21
								40	22
2.95×4.15	0.55×0.55							45	23
								60	24
3.20×4.85	0.60×0.65	45	25						
		60	26						
		0~+40	-20~+60				※2	60	17
2.95×4.15	0.55×0.55	0~+50	-20~+70				TN Positive	50	27
								70	28
3.20×4.85	0.60×0.65							45	29
								65	30
3.20×4.85	0.60×0.65							70	31
								100	32
		0~+40	-20~+60					※2	100	17
2.95×4.15	0.55×0.55	0~+50	-20~+70	TN Positive	40	33			
/	0.63×0.63	0~+40	-20 ~+60	+5	-12	Directly from CPU	STN Blue	150	35
	-20				E-1330 (External)	220		37	
						370		39	
						HD 61830B (External)		400	41

Available Option List

STANLEY has a variety of optional types to meet a wide range of customer requirements.
When ordering optional types, 100 pieces are required as the minimum ordering quantity.

LCD Type Number of Characters Viewing Direction Back light Source			TN						STN				
			Positive			Negative			Yellow		Blue	Gray	
						Wide Temperature type							
			Type	Reflective	LED ^{※1}	(White CFL) ^{※4}	Reflective	LED ^{※1}	LED ^{※1}	(Reflective) ^{※4}	(Yellow LED) ^{※4}	(White CFL) ^{※4}	(Reflective) ^{※4}	(White CFL)^{※4}
Character Type GMD Series	16×1	6:00	Standard ^{※2} 1610F	Standard ^{※2} 1610FL*	—	1614F	1614FL*	1614FNL*	1610FS	1610FSLY	—	1610FG	—
	1610F	12:00	1611F	1611FL*	—	1615F	1615FL*	1615FNL*	1611FS	1611FSLY	—	1611FG	—
	16×2	6:00	Standard ^{※2} 1620A	Standard ^{※2} 1620AL*	—	1624A	1624AL*	1624ANL*	1620AS	1620ASLY	—	1620AG	—
	1620A	12:00	1621A	1621AL*	—	1625A	1625AL*	1625ANL*	1621AS	1621ASLY	—	1621AG	—
	16×4	6:00	Standard ^{※2} 1640A	Standard ^{※2} 1640AL*	—	1644A	1644AL*	1644ANL*	1640AS	1640ASLY	—	1640AG	—
	1640A	12:00	1641A	1641AL*	—	1645A	1645AL*	1645ANL*	1641AS	1641ASLY	—	1641AG	—
	20×2	6:00	Standard ^{※2} 2020A	Standard ^{※2} 2020AL*	Standard ^{※2} 2020ETW	2024A	2024AL*	2024ANL*	2020AS	2020ASLY	Standard ^{※2} 2020EBTW	2020AG	Standard ^{※2} 2020EGTW
	2020A	12:00	2021A	2021AL*	2021ETW	2025A	2025AL*	2025ANL*	2021AS	2021ASLY	2021EBTW	2021AG	2021EGTW
	20×4	6:00	Standard ^{※2} 2040A	Standard ^{※2} 2040AL*	—	2044A	2044AL*	2044ANL*	2040AS	2040ASLY	—	2040AG	—
	2040A	12:00	2041A	2041AL*	—	2045A	2045AL*	2045ANL*	2041AS	2041ASLY	—	2041AG	—
	24×2	6:00	Standard ^{※2} 2420A	Standard ^{※2} 2420AL*	—	2424A	2424AL*	2424ANL*	2420AS	2420ASLY	—	2420AG	—
	2420A	12:00	2421A	2421AL*	—	2425A	2425AL*	2425ANL*	2421AS	2421ASLY	—	2421AG	—
	40×2	6:00	Standard ^{※2} 4020A	Standard ^{※2} 4020AL*	Standard ^{※2} 4020ETW	4024A	4024AL*	4024ANL*	4020AS	4020ASLY	Standard ^{※2} 4020EBTW	4020AG	Standard ^{※2} 4020EGTW
	4020A	12:00	4021A	4021AL*	4021ETW	4025A	4025AL*	4025ANL*	4021AS	4021ASLY	4021EBTW	4021AG	4021EGTW
	16×4	6:00	Standard ^{※2} 1640B	—	—	1644B	—	—	1640BS	—	—	1640BG	—
	1640B	12:00	1641B	—	—	1645B	—	—	1641BS	—	—	1641BG	—

<div> <div>LCD Type</div> <div>Number of Dots</div> <div>Viewing Direction</div> <div>Light Source</div> </div>			STN	
			Yellow	Blue
			White CFL	White CFL
Graphic Type GMT Series	128×48Dots	6:00	12048BSTW	Standard ^{※2} 12048BBTW
	12048B	12:00	12148BSTW	12148BBTW
	256×64Dots	6:00	25064ASTW	Standard ^{※2} 25064ABTW
	25064A	12:00	25164ASTW	25164ABTW
	256×128Dots	6:00	25012ASTW	Standard ^{※2} 25012ABTW
	25012A	12:00	25112ASTW	25112ABTW
	256×128Dots (CFL×2)	6:00	25012ESTW	Standard ^{※2} 25012EBTW
	25012E	12:00	25112ESTW	25112EBTW

Note) ※1 The symbol which shows the LED backlighting color should be superseded by the following characters instead of * mark
(See Page 8)

R : Red
O : Orange
AY : Yellow
Y : Yellow
G : Green

※2 Standard mark means the standard products shown in page 3.

※3 LED backlighting module of STN type is only available in a combination of STN yellow mode and Y type backlighting only.

※4 Marked () types are under development.

▼ How to read part number

GMD 16 2 □ A ○ / **GMF 25 □ 64 A ○**

① ② ③ ④ Suffix No. ⑧ / ① ⑤ ⑥ ⑦ Suffix No. ⑧

	Means		Means
①	Series No. (GMD: Character type, GMF: Graphic type)	⑤	GMF Series Number of Dots in Horizontal Line (2 digits)
②	GMD Series Number of Characters	⑥	GMF Series Viewing Direction, Operating Temperature
③	GMD Series Number of Lines	⑦	GMF Series Number of Dots in Vertical Line (2 digits)
④	GMD Series Viewing Direction, Operating Voltage Supply Voltage	⑧	LCD Type, LCD Mode, Backlighting

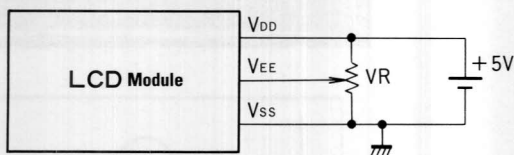
④ GMD Series				
LCD Type	□	Viewing Direction	Operating Temperature (°C)	Supply Voltage (V)
TN Type	0	6 : 00	0 ~ + 50	+ 5
	1	12 : 00	0 ~ + 50	+ 5
	4	6 : 00	- 20 ~ + 70 ※	± 5
	5	12 : 00	- 20 ~ + 70 ※	± 5
STN Type	0	6 : 00	0 ~ + 50 ※	+ 5
	1	12 : 00	0 ~ + 50 ※	+ 5

※ for Reflective type

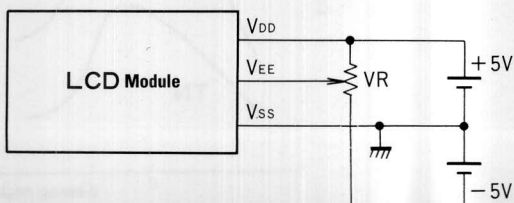
⑥ GMF Series			
LCD Type	□	Viewing Direction	Operating Temperature (°C)
STN Type	0	6 : 00	0 ~ + 40
	1	12 : 00	0 ~ + 40

• Example of Power Supply Circuit for GMD Series. (Example for GMF series are shown in each page.)

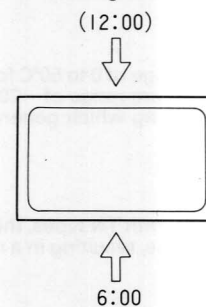
a. In case of 5V



b. In case of ±5V



• Viewing Direction



6:00 direction is as standard.
12:00 direction is as optional.

⑧ GMD & GMF Series				
○	LCD Type	LCD Mode	Back-lighting	Backlighting Color
—	TN Positive	Reflective	—	—
LR	TN Positive	Transmissive	LED	Red
LO	TN Positive	Transmissive	LED	Orange
LAY	TN Positive	Transmissive	LED	Yellow
LY	TN Positive	Transmissive	LED	Yellow
LG	TN Positive	Transmissive	LED	Green
NLR	TN Negative	Transmissive	LED	Red
NLO	TN Negative	Transmissive	LED	Orange
NLAY	TN Negative	Transmissive	LED	Yellow
NLY	TN Negative	Transmissive	LED	Yellow
NLG	TN Negative	Transmissive	LED	Green
TW	TN Positive	Transmissive	CFL	White
S	STN Yellow	Reflective	—	—
SLY	STN Yellow	Transmissive	LED	Yellow
STW	STN Yellow	Transmissive	CFL	White
BTW	STN Blue	Transmissive	CFL	White
G	STN Gray	Reflective	—	—
GTW	STN Gray	Transmissive	CFL	White

Available Option List

▼ LCD Type

TN Type

This is the most typical general-purpose type LCD, being used in applications ranging from watches and calculators to Dot Matrix Modules.

● TN Positive Image Type (Basic Type)

The most typical general-purpose LCD of the TN types.
This type features black characters (or drawings) on a neutral gray background.
Usable in three modes: Reflective mode, Transmissive mode and Transflective mode.



● TN Negative Image Type

This has reversed image of positive type, with a white display on a black background.
Usable in Transmissive mode only.



● Wide Temperature Type

In contrast with the operating temperature range of 0 to 50°C for normal TN types, this type features a wide operating temperature range of -20 to 70°C. (This LCD is particularly effective in use with backlighting which generates heat.)

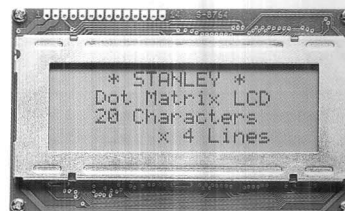


STN Type

Compared with TN types, this high-resolution display LCD intended for Dot Matrix Display has an increased twisted angle, resulting in a more than two-fold improvement in contrast and viewing angle characteristics.

● STN Yellow Type

Dark blue display on a yellow-green background.
This is the most typical general-purpose type of high-contrast STN types.
Usable in three modes: Reflective mode, Transmissive mode and Transflective mode.



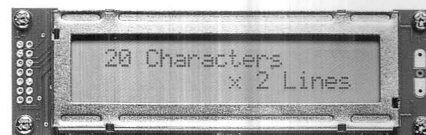
● STN Blue Type

Backlight color display on a blue background.
This type intended specifically for use in combination with a white light source.
Usable in transmissive mode only.



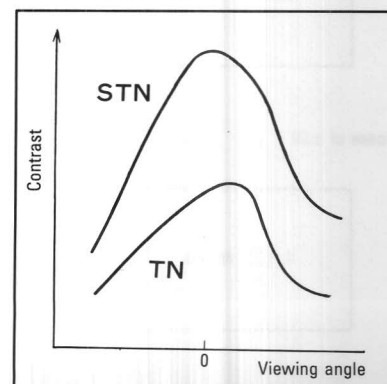
● STN Gray Type

Dark blue display on a blue-gray background. This type features an improvement that provides a display which appears natural with its surround colors, when the yellow mode background is blanked. Usable in reflective mode.



Features of Each Mode

LCD Type	Background Color	Display Color	Viewing Direction	Contrast	LCD mode			Temperature	
					Reflective	Transmissive	Transflective	Opr.	Stg.
TN	Positive	Neutral gray	Black	○	○	◎	○	0~	-20~
	Negative	Black	Clear	○	○	×	△	+50	+70
	Wide Tem.	—	—	○	○	—	—	-20~+70	-30~+80
STN	Yellow	Yellow-Green	Dark blue	◎	◎	◎	○	0~	-20~
	Blue	Blue	Clear	◎	◎	×	△	+40	+60
	Gray	Blue-Gray	Dark blue	◎	◎	◎	△		



Example of Contrast-Viewing Angle Curve

▼ Backlighting

STANLEY Dot Matrix LCDs feature three types of backlighting: high-intensity, long-life LEDs, CFL with brightness and good color rendition, and slim-line EL.

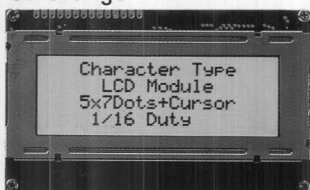
LED Backlighting



R: Red



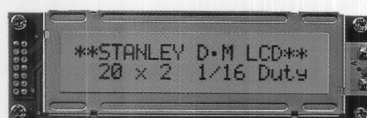
O: Orange



AY: Yellow (Amber)

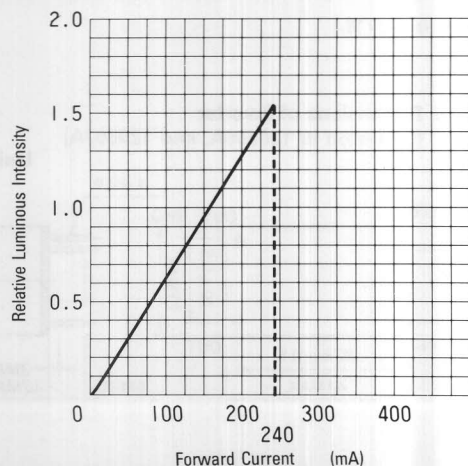


Y: Yellow



G: Green

fig.1 Example of Relative Luminous Intensity vs. Forward Current (For GMD1610FLY)



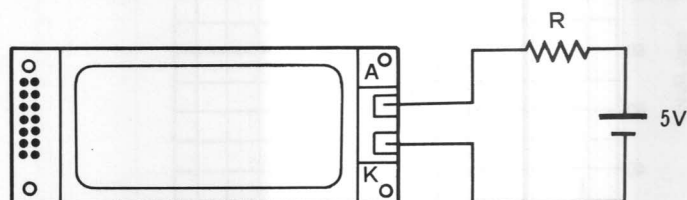
■ Features

- Long-life, bright and uniform backlighting
- Operating voltage: 4.4-4.7V (Using external resistor)
- Five colors are available
- The use of high-intensity LEDs and unique illumination technology enable effective backlighting with a small number of chips.

■ Specifications

Please see each page for standard types.

■ Example of power supply circuit for LED Backlighting Unit.



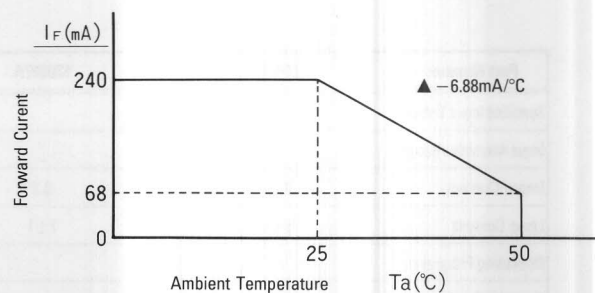
R: Forward current limiting resistor

* Always use an externally connected resistor (R) for the backlighting unit.

■ Precaution for usage

The operating temperature range of LCD modules with LED backlighting is specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

fig.2 Example of Forward Current vs. Ambient Temperature (For GMD1610FLY)



Available Option List

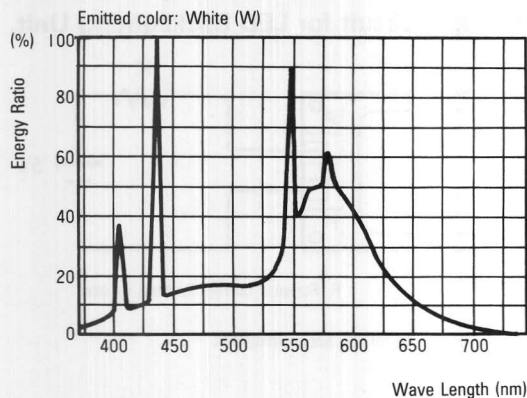
CFL Backlighting



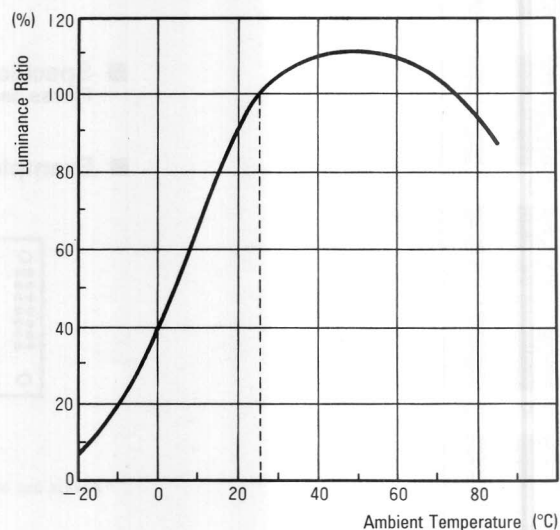
■ Features

- Long life and low heat generation.
- Excellent color performance and clean display colors.
- Low power consumption.
- Variable light adjustment is available.
- Strong structure against vibration.

■ Emitted Spectral Curves

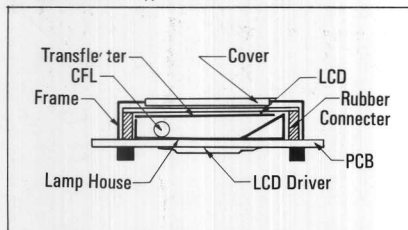


■ Luminance Ratio VS. Ambient Temperature

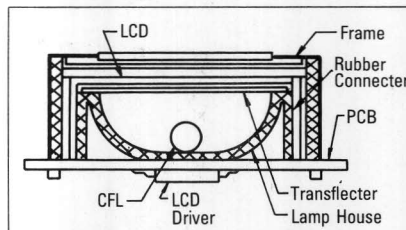


■ Structure of CFL Backlighting Unit

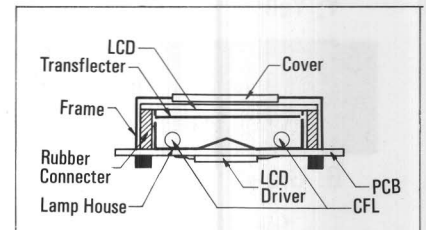
For GMF 12048B Type, GMF25012A Type



For GMF25064A Type



For GMF25012E Type



■ Recommended Inverters for CFL

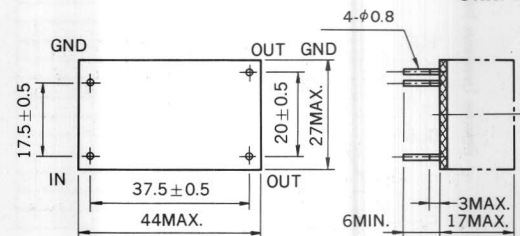
STANLEY has available inverters for use as a CFL drive power supply. These dedicated inverters are designed specifically to match the CFL characteristics, enabling high-intensity, long life and high-efficiency illumination.
(Recommended Inverters for CFL of GMD Series are shown in page 18.)

Ta = 25°C

Part Number	120606A	120607A	Unit
Specified Input Voltage	12		Vave
Input Alternative Range	±10		%
Input Current	0.25	0.3	less than Aave
Load Current	6±1	7±1	mArms
Operating Frequency	25 ⁺¹⁰ ₋₅		kHz
Operating Temperature	0~50		°C
Operating Humidity	30~85 (No dew)		%RH
Storage Temperature	-20~85		°C
Storage Humidity	20~90 (No dew)		%RH

■ Dimensions of Inverter (Common in 120606A, and 120607A)

Unit: mm



EL Backlighting

■ Features

- Thin (less than 1.3mm) & Light weight (200mg/cm²)
- Uniform light source

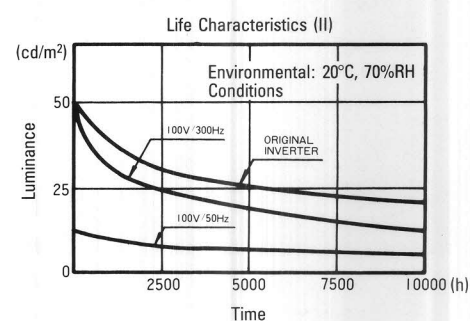
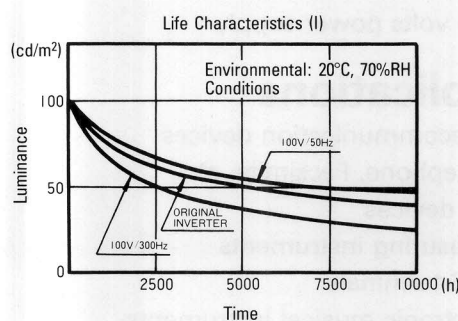
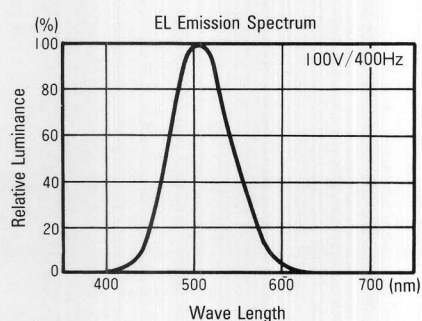
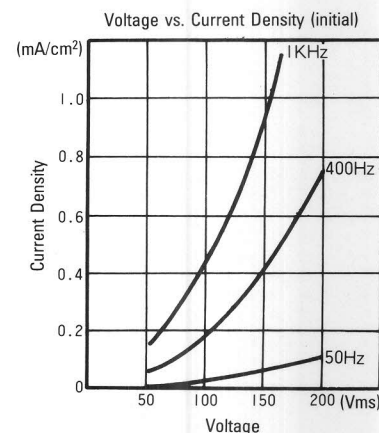
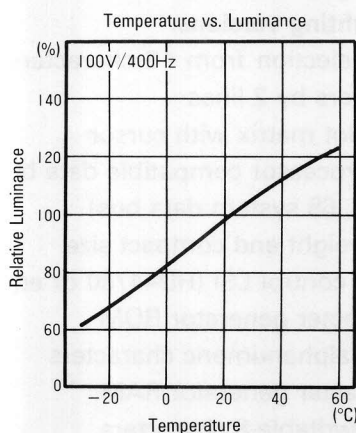
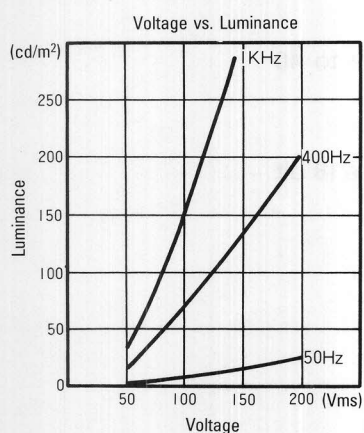


■ Example of Specifications for EL

Ta = 25°C

Item	Condition	Ratings			Unit
		Min.	Typ.	Max.	
Operating Voltage	—	50	—	250	AC V
Operating Frequency	—	50	—	1,000	Hz
Power Consumption	—	—	—	10	mWcm ²
Operating Temperature	100V 400Hz	-30	—	60	°C
Storage Temperature		-40	—	80	
Brightness		—	(60)	—	cd/cm ²
	Blue-green	—	(55)	—	
	White	—	(55)	—	

■ Basic Characteristics

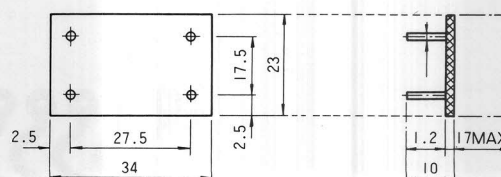


■ Recommended Inverters for EL

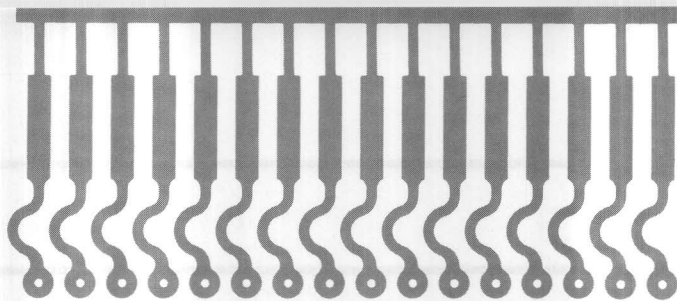
STANLEY inverters are designed to match STANLEY EL elements, and minimal lost of intensity with temperature variations and aging, as well as high-efficiency illumination.

Item	Condition	Ratings			Unit
		Min.	Typ.	Max.	
Input Voltage	—	2.5	5.0	5.5	V
Input Current	Vin = 5V	25	34	42	mA
Output Voltage	—	72	82	92	Vrms
Output Frequency	—	360	410	460	Hz
Input Current under over voltage	Vin = 6V	—	—	60	mA
Operating Temperature	—	-10	—	60	°C
Storage Temperature	—	-20	—	70	°C

■ Example of Dimensions of Inverter



Note) Regarding EL back lighting type, please refer to the catalog, EB-34.



Character Dot Matrix Modules

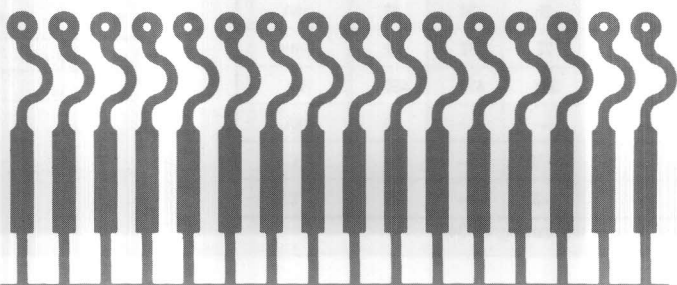
GMD Series

Features

- A new product CFL backlighting version is added to existing production lines of reflective and LED backlighting versions.
- Wide selection from 16 characters by 1 line to 40 characters by 2 lines
- 5 × 7 dot matrix with cursor
- Microprocessor compatible data bus interface (8 bit or 4 bit, 68 system data bus)
- Light weight and compact size
- Built-in control LSI (HD44780 or equivalent)
 - Character generator ROM
 - 96 alphanumeric characters
 - Character generator RAM
 - Rewritable 8 characters
- + 5 volts power supply

Applications

- Telecommunication devices
(Telephone, Facsimile, etc.)
- OA devices
- Measuring instruments
- POS terminals
- Electronic musical instruments
- Other terminal display devices



Characteristics

Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Logic Circuit Supply Voltage	$V_{DD}-V_{SS}$	0	7.0 (6.5) ※1	V
LCD Driver Circuit Supply Voltage	$V_{DD}-V_{EE}$	0	13.5 (6.5) ※1	V
Input Voltage	V_I	V_{SS}	V_{DD}	V
Operating Temperature	T_{op}	0	50	°C
Storage Temperature	T_{stg}	-20	70	°C

Note) ※ 1: The figures in () are applicable to GMD1640A, GMD2040A and GMD4020E Series.

Electrical Characteristics

$V_{DD}=5.0\pm0.25V$ $T_a=0\sim+50^\circ C$

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input "High" Voltage	V_{IH}	—	2.2	—	V_{DD}	V
Input "Low" Voltage	V_{IL}	—	0	—	0.6	V
Output "High" Voltage	V_{OH}	$I_{OH} = -0.205mA$	2.4	—	—	V
Output "Low" Voltage	V_{OL}	$I_{OL} = 1.2mA$	—	—	0.4	V
Clock frequency	f_{osc}	—	190	270	350	KHz

Optical Characteristics

$T_a = +25^\circ C$

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage for LCD «1/16 Duty»	$V_{DD}-V_{EE}$	$T_a = 50^\circ C$	—	3.7	—	V
		$T_a = 25^\circ C$	—	4.4	—	V
		$T_a = 0^\circ C$	—	4.9	—	V
Contrast ratio (Fig. 1)	K	$\phi = 20^\circ$ $\theta = 0^\circ$	3	—	—	—
Viewing Angle (Fig. 2)	$\phi_2 - \phi_1$	$\theta = 0^\circ$ $K \geq 1.4$	20	—	—	Degree
	θ	$\phi = 20^\circ$ $K = 1.4$	± 30	—	—	Degree
Response time (Fig. 3)	rise	$\phi = 20^\circ$ $\theta = 0^\circ$	—	150	250	m sec
	fall	$\phi = 20^\circ$ $\theta = 0^\circ$	—	150	250	m sec

Note) • This specifications is applicable to TN positive type LCD. Please ask us when you need the specifications of other LCD except TN positive type shown in the above list.
• Measured on LCD only. If there is any heat source (LED, CFL, etc.) exist around LCD the temperature increase should be taken into consideration.

Fig. 1 Definition of contrast ratio (K)

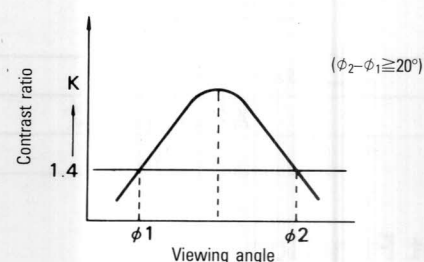
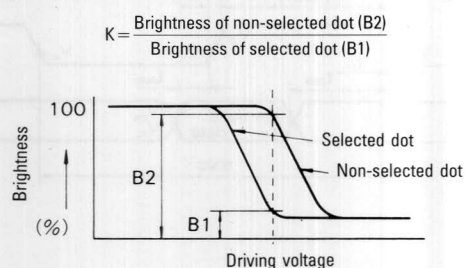
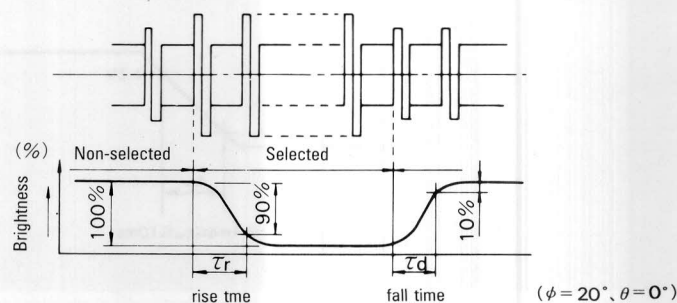
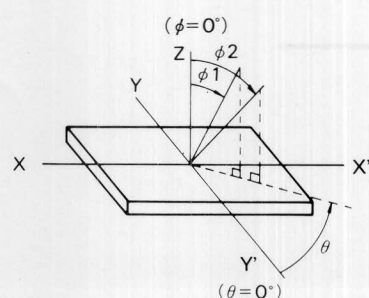


Fig. 2 Definition of viewing angle $\phi_2 - \phi_1$, θ Fig. 3 Definition of response time



Characteristics of Control LSI

Timing Chart (interface timing)

Data Write

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Enable cycle time	tcyc	Fig. 4	1.0	—	—	μ sec
Enable pulse width	PwEH	Fig. 4	450	—	—	n sec
Enable rise/fall time	t_{Er}/t_{Ed}	Fig. 4	—	—	25	n sec
Address set up time	t_{AS}	Fig. 4	140	—	—	n sec
Address hold time	t_{AH}	Fig. 4	10	—	—	n sec
Data set up time	t_{DSW}	Fig. 4	195	—	—	n sec
Hold time	t_H	Fig. 4	10	—	—	n sec

Data Read

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Enable cycle time	tcyc	Fig. 5	1.0	—	—	μ sec
Enable pulse width	PwEH	Fig. 5	450	—	—	n sec
Enable rise/fall time	t_{Er}/t_{Ed}	Fig. 5	—	—	25	n sec
Address set up time	t_{AS}	Fig. 5	140	—	—	n sec
Address hold time	t_{AH}	Fig. 5	10	—	—	n sec
Data delay time	t_{DDR}	Fig. 5	—	—	320	n sec
Data hold time	t_{DHR}	Fig. 5	20	—	—	n sec

Fig. 4 Data Write from MPU to Module

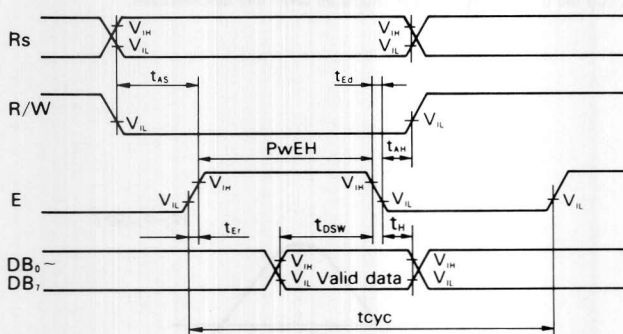
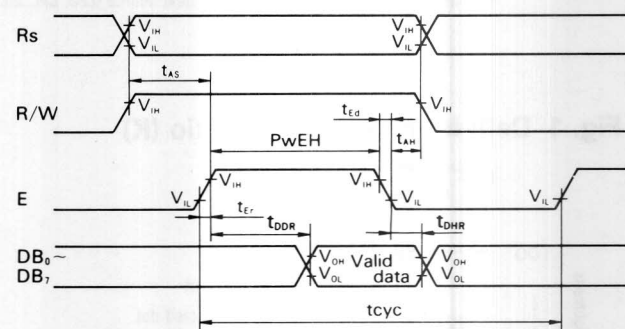
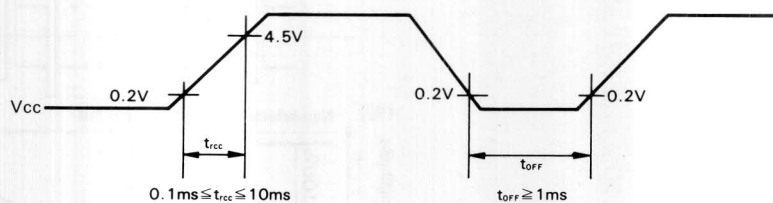


Fig. 5 Data Read from Module to MPU



Reset Function

The LCD Module automatically performs initialization (reset) when power is turned on (using internal reset circuit). However, since initialization may not be performed completely depending on the rise time of the power supply when it is turned on, pay attention to the following time-relationship.



Note) Since the internal reset circuit will not operate normally unless the preceding conditions are met, initialize by instruction.

Instructions

Instruction	Code										Description	Execution time (Max) (when fosc is 250kHz)	
	R _S	R/W	DB ₇	DB ₆	DB ₅	DB ₄	DB ₃	DB ₂	DB ₁	DB ₀			
Clear display	0	0	0	0	0	0	0	0	0	1	clears entire display and sets DD RAM address 0 in address counter.	1.64m sec	
Return home	0	0	0	0	0	0	0	0	0	1	*	sets DD RAM address 0 in address counter. Also returns display being shifted to original position. DD RAM counters remain unchanged.	1.64m sec
Entry mode set	0	0	0	0	0	0	0	0	1	I/D	S	sets cursor move direction and specifies shift of display. These operations are performed during data write and read.	40μ sec
Display ON/OFF control	0	0	0	0	0	0	0	1	D	C	B	sets ON/OFF of entire display (D), cursor ON/OFF (C), and blink of cursor position character (B).	40μ sec
Cursor or display shift	0	0	0	0	0	0	1	S/C	R/L	*	*	moves cursor and shifts display without changing DD RAM contents.	40μ sec
Function set	0	0	0	0	0	1	DL	N	F	*	*	sets interface data length (DL), number of display lines (N) and character font (F).	40μ sec
Set CG RAM address	0	0	0	0	1	ACG					sets CG RAM address. CG RAM data are sent and received after this setting.	40μ sec	
Set DD RAM address	0	0	0	1	ADD					sets DD RAM address. DD RAM data are sent and received after this setting.	40μ sec		
Read busy flag & address	0	1	BF	AC					reads busy flag (BF) indicating internal operation is being performed and reads address counter contents.	1μ sec			
Write data to CG or DD RAM	1	0	Write Data					writes data into DD RAM or CG RAM	40μ sec				
Read data from CG or DD RAM	1	1	Read Data					reads data from DD RAM or CG RAM	40μ sec				
<div>I/D = 1: Increment I/D = 0: Decrement S = 1: Accompanies display shift S/C = 1: Display shift S/C = 0: Cursor move R/L = 1: Shift to the right R/L = 0: Shift to the left DL = 1: 8 bits, DL = 0: 4 bits N = 1: 2 lines, N = 0: 1 line. *Note 1) F = 1: 5 × 10 dots, F = 0: 5 × 7 dots BF = 1: Internally operating BF = 0: Can accept instruction</div>											<div>DD RAM: Display data RAM CG RAM: Character generator RAM ACG : CG RAM address ADD : DD RAM address Corresponds to cursor address AC : Address counter used for both CG and DD RAM address * : Invalidity</div>	<div>Execution time changes when frequency changes. (Example) When fosc is 270kHz: $40\mu\text{ sec} \times \frac{250}{270} = 37\mu\text{ sec}$</div>	

Note 1) In the case of GMD 1610F, GMD1610FL (16 character 1 line 1/16 duty), set N = 1.

Operation Example

■ 8-bit operation, 2 line display

No.	Instruction (Rs R/W DB ₇ ~DB ₀)	Display	Operation
1	Power supply ON (Initialized by the internal reset circuit)		Initialized. No display appears.
2	Function set (00001110**)		Set 8 bit operation and select 2-line display and 5 × 7 dot character font.
3	Display ON/OFF control (0000001110)		Turn on display and cursor. Entire display is in space mode because of initialization.
4	Entry mode set (0000000110)		Set mode to increment the address by one and to shift the cursor to the right, at the time of write, to the CG/DD RAM. Display is not shifted.
5	Write data to CG RAM/DD RAM (1001010011)	S	Write "S". The DD RAM has already been selected by initialization. The cursor is incremented by one and shifted to the right.
6	Write data to CG RAM/DD RAM (1001010100)	ST	Write "T".
...
11	Write data to CG RAM/DD RAM (1001011001)	STANLEY	Write "Y".
12	Set DD RAM address (0011000000)	STANLEY	Set RAM address so that the cursor is positioned at the head of the 2nd. line.
13	Write data to CG RAM/DD RAM (1000111000)	STANLEY 8	Write "8".
...
20	Write data to CG RAM/DD RAM (1001000100)	STANLEY 8bitMOD	Write "D".
21	Write data to CG RAM/DD RAM (1001000101)	STANLEY 8bitMODE	Write "E".

■ In the case of 4-bit operation

When power is turned on, 8-bit operation is automatically selected, so the program must be set functions prior to 4-bit operation. One operation is completed in two accesses of 4-bit operations.

Note: For 2 lines display, the cursor automatically moves from the first to the second line after the 40th digit of the first line has been written.

Correspondence between Character Code and Character Pattern

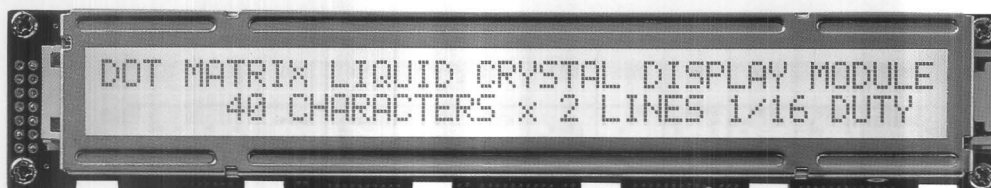
Upper 4bit Lower 4bit	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)		0	1	2	3	4	5	6	7	8	9	A
xxxx0001	(2)	!	1	!@	Q	a	q	7	+	4	2	3	0
xxxx0010	(3)	"	2	B	R	b	r	"	/	U	x	e	B
xxxx0011	(4)	#	3	C	S	c	s	#	7	E	e	3	0
xxxx0100	(5)	*	4	D	T	d	t	*	1	k	k	u	0
xxxx0101	(6)	%	5	E	U	e	u	%	7	+	1	5	0
xxxx0110	(7)	0	6	F	V	f	v	0	7	+	1	5	0
xxxx0111	(8)	'	7	G	W	g	w	'	7	+	1	5	0
xxxx1000	(1)	(	8	H	X	h	x	(	7	+	1	5	0
xxxx1001	(2)	)	9	I	Y	i	y	)	7	+	1	5	0
xxxx1010	(3)	*	0	J	Z	j	z	*	7	+	1	5	0
xxxx1011	(4)	+	1	K	Z	k	z	+	7	+	1	5	0
xxxx1100	(5)	,	<	L	#	1	1	,	7	+	1	5	0
xxxx1101	(6)	-	=	M	J	m	j	-	7	+	1	5	0
xxxx1110	(7)	.	>	N	^	n	^	.	7	+	1	5	0
xxxx1111	(8)	/	7	0	_	0	+	/	7	+	1	5	0

Character Generator RAM (CG RAM)

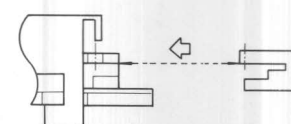
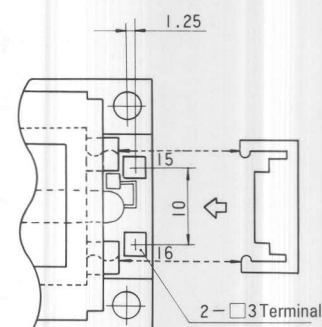
The character generator RAM is the RAM with which the user can rewrite character patterns by program. With 5×7 dots, 8 types of character patterns can be written. Write the character codes in the left columns of above table. For details, please consult with Stanley.

GMD4020E ○*

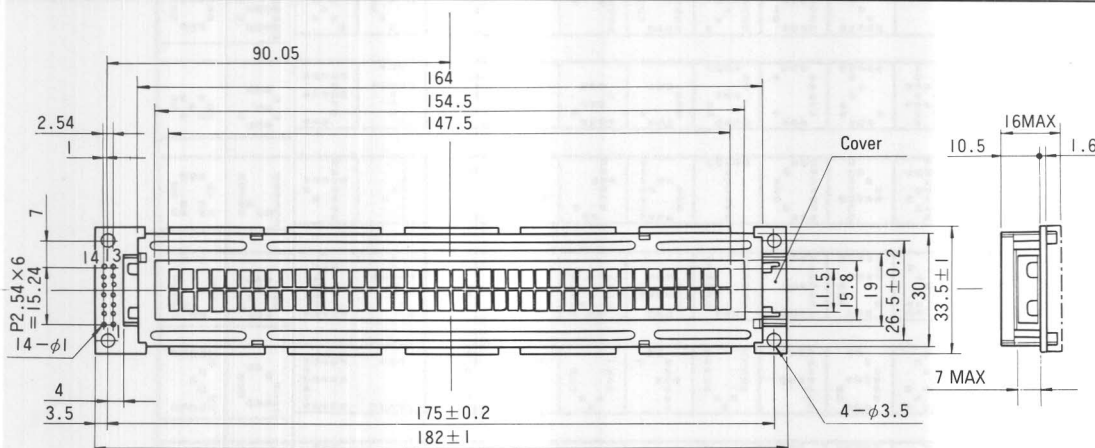
40 Characters × 2 Lines 1/16 Duty



● Detail of Cover Part

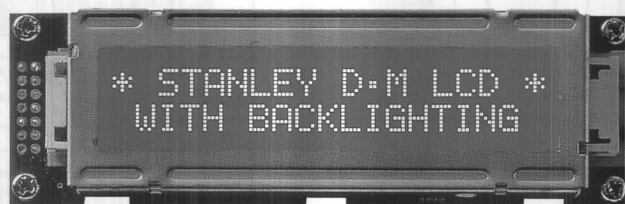


● Module Dimensions (With CFL BACKLIGHTING)

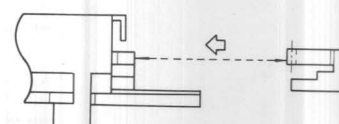
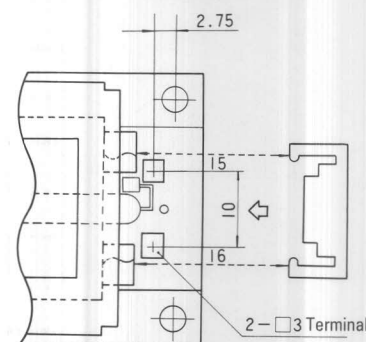


GMD2020E ○*

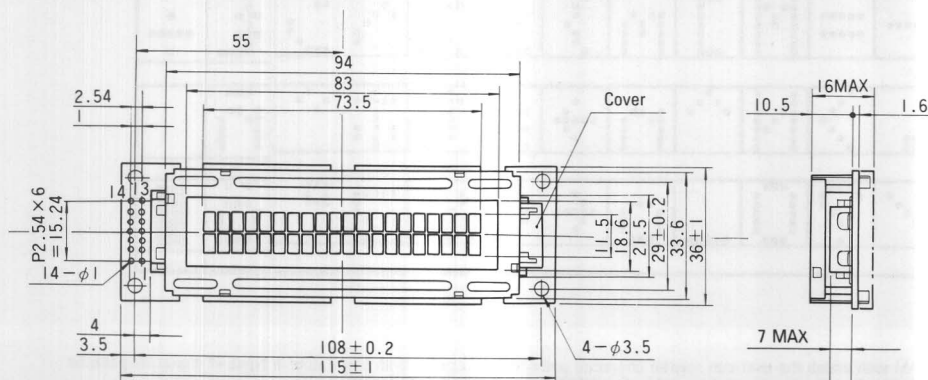
20 Characters × 2 Lines 1/16 Duty



● Detail of Cover Part



● Module Dimensions (With CFL BACKLIGHTING)



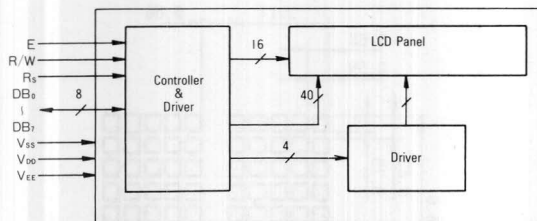
※Note) The symbol which shows the LCD type should be superseded by following characters instead of ○ mark.

GTW: STN Gray type
BTW: STN Blue type
TW: TN Positive type

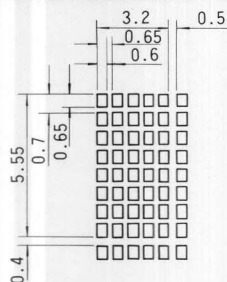
GMD4020E[○]*
GMD2020E[○]*

with CFL BACKLIGHTING

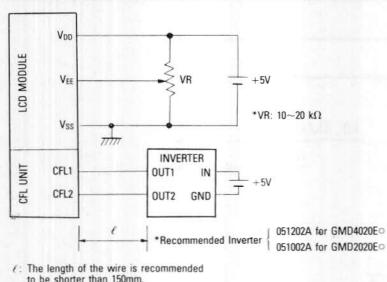
● Block Diagram



● Display Pattern



● Example of Power Supply Circuit



● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply OV (GND) +5V for Liquid Crystal Driving
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register Select L: Instruction Input H: Data Input
5	R/W	H/L	L: Data Write (Module ← MPU) H: Data Read (Module → MPU)
6	E	H/L	Operation start signal for data read/write
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB7 can be used as a BUSY flag.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
15	CFL1	—	Power Supply for Inverter "OUT 1" Terminal
16	CFL2	—	Power Supply for Inverter "OUT 2" Terminal

● Optical Characteristics

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage for LCD «1/16 Duty» *1	V _{DD} -V _{EE}	T _a = 50°C	3.8	3.9	4.0	V
		T _a = 25°C	4.1	4.2	4.3	V
		T _a = 0°C	4.5	4.6	4.7	V
Contrast Ratio (Fig. 1) *2	K	φ = 20° θ = 0°	3	—	—	—
Viewing Angle (Fig. 2) *2	φ ₂ -φ ₁	θ = 0° K ≥ 1.4	40	—	—	Degree
	θ	φ = 20° K = 1.4	±30	—	—	Degree
Response time rise (Fig. 3) *2	τ _r	φ = 20° θ = 0°	—	200	250	m sec
Response time fall (Fig. 3) *2	τ _d	φ = 20° θ = 0°	—	200	250	m sec

Note) *1 This specification is applicable to STN Gray type LCD. Please ask us when you need the specifications of other LCD except STN Gray type shown in the above list.

*2 Fig. 1 ~ Fig. 3 are shown in page 12.

*3 Measured on LCD only. If there is any heat source (LED, CFL, etc...) exists around LCD, the temperature increase should be taken into consideration.

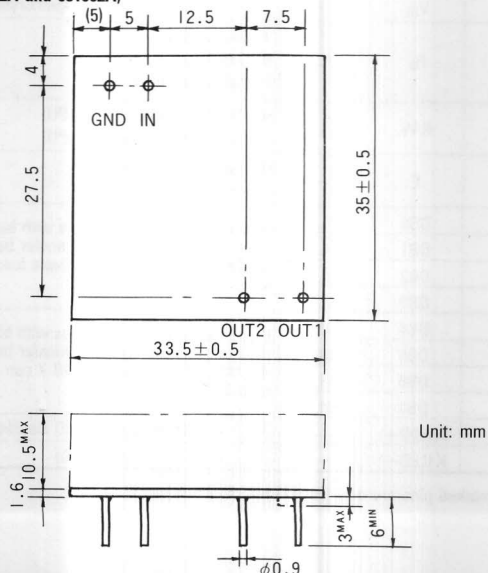
● Recommended Inverter for CFL

Item	Ratings		Unit
Part Number	051202A	051002A	—
Part Number of LCD Module	GMD4020E [○]	GMD2020E [○]	—
Specified Input Voltage	+5	+5	V
Input Alternative Range	±10	±10	%
Input Current	+0.45	+0.35	less than Aave
Load Current	2.5±0.5	2.5±0.5	mArms
Load Voltage	340±20	230±20	V
Operating Frequency	65±10	65±10	kHz
Operating Temperature	+0 ~ +50		°C
Operating Humidity	+30 ~ +85 *		%RH
Storage Temperature	-20 ~ +85		°C
Storage Humidity	+20 ~ +90 *		%RH

* Subject to condition without dew.

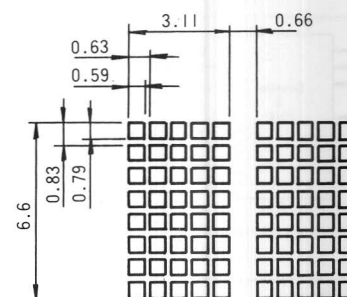
Note) The length of the wire is recommended to be shorter than 150mm. If the connecting wires between CFL terminals and inverters are too long, you may encounter "light up at low temperature" or similar conditions caused by insufficient electric current.

▼ Dimensions of Inverter (common in 051202A and 051002A)

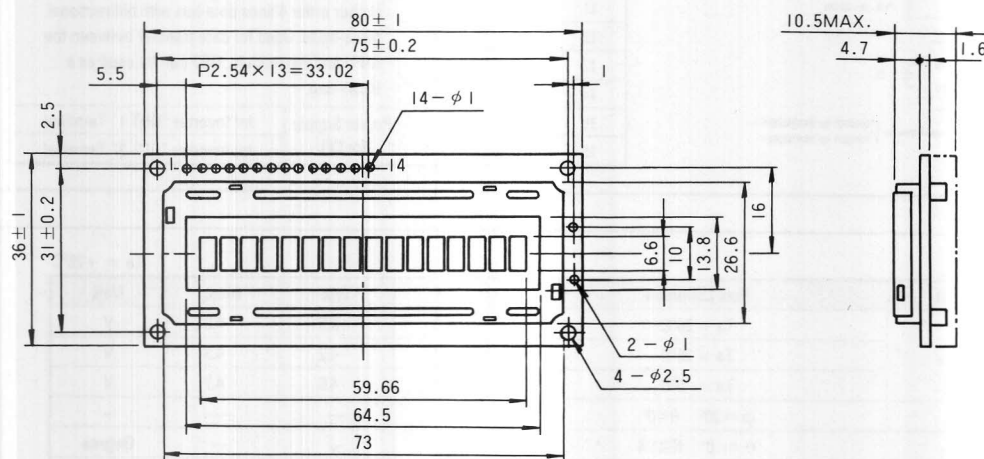


GMD1610F 16 Characters × 1 Line 1/16 Duty

● Display Pattern



● Module Dimensions (Reflective)



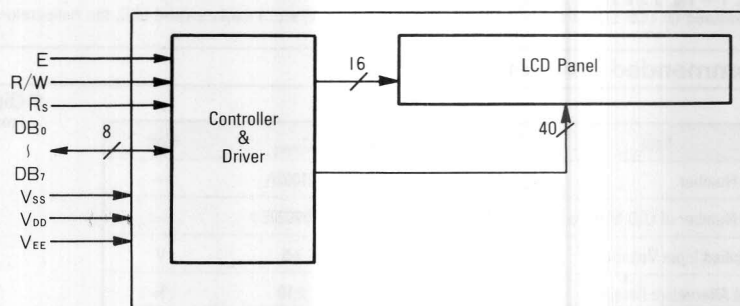
Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V_{SS}	—	Power Supply
2	V_{DD}	—	
3	V_{EE}	—	
4	R_S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
*15	A (LED+)	—	Supply Voltage for LED Backlighting
*16	K (LED-)	—	OV (GND)

Note) * marked pins are only for LED backlighting type.

● Block Diagram



● DD RAM Address

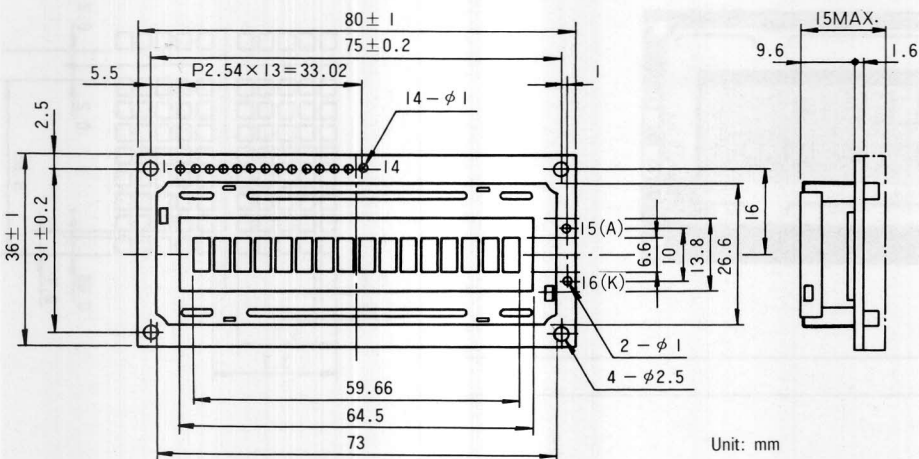
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

RAM area: 00H ~ 27H & 40H ~ 67H

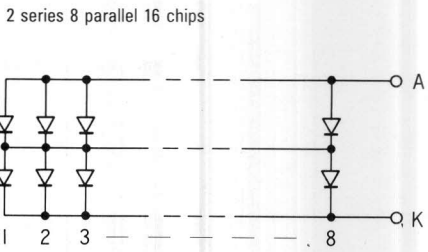
Note) Please select 2 line display.

GMD1610FL* With LED BACKLIGHTING

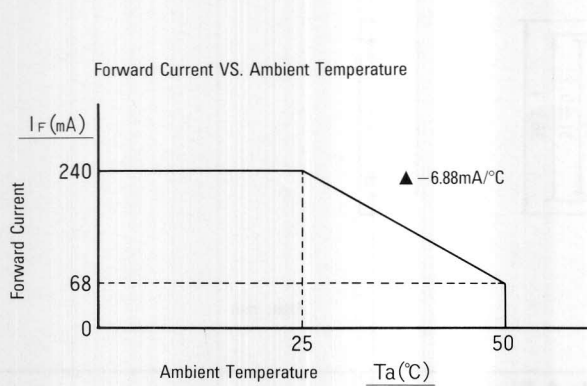
Module Dimensions (with LED BACKLIGHTING)



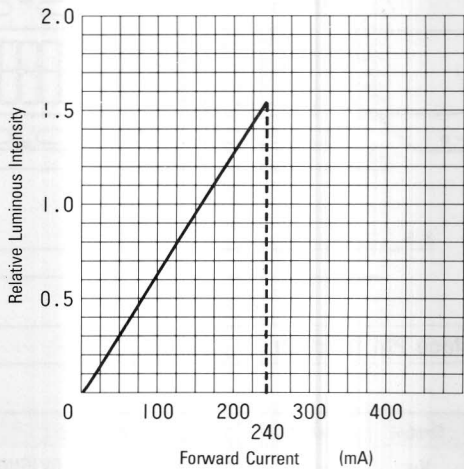
Circuit Diagram of LED Backlighting



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

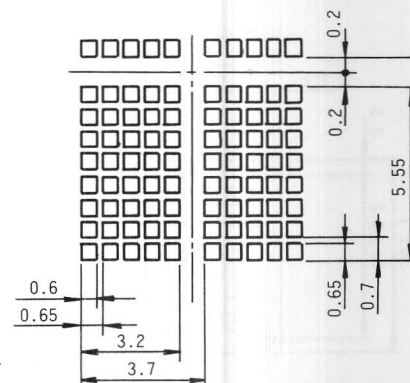
Ta = 25°C

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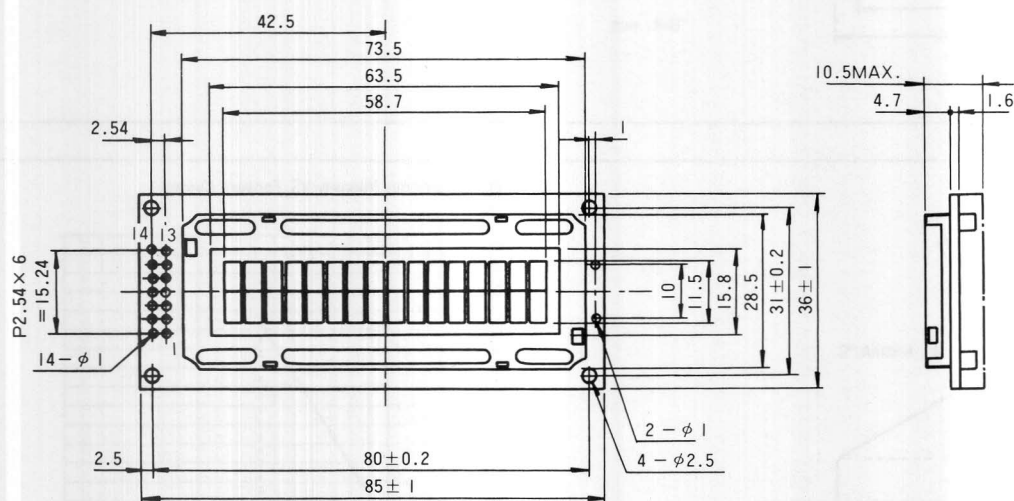
Note) Above specifications should be applicable to the LED backlighting itself.

GMD1620A 16 Characters × 2 Lines 1/16 Duty

● Display Pattern



● Module Dimensions (Reflective)



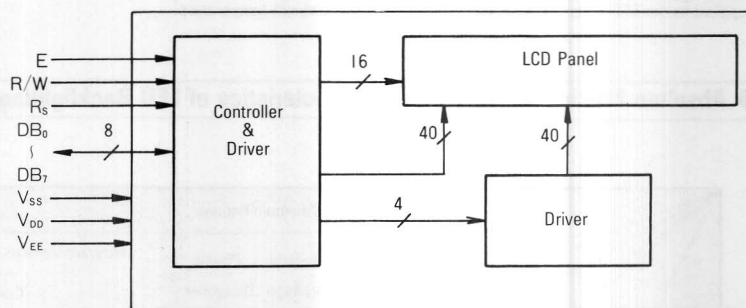
Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply 0V (GND) + 5V for Liquid Crystal driving
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
*15	A (LED+)	—	Supply Voltage for LED Backlighting
*16	K (LED-)	—	0V (GND)

Note) * marked pins are only for LED backlighting type.

● Block Diagram



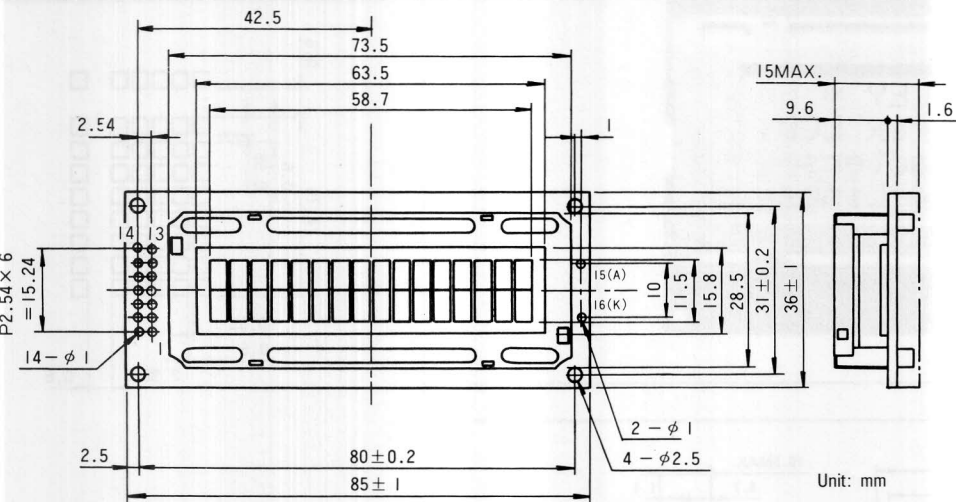
● DD RAM Address

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Line 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

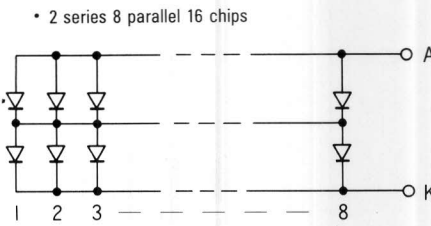
RAM area: 00 H ~ 27 H & 40 H ~ 67 H

GMD1620AL* With LED BACKLIGHTING

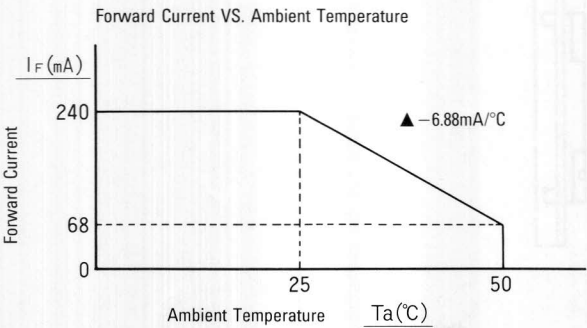
Module Dimensions (With LED BACKLIGHTING)



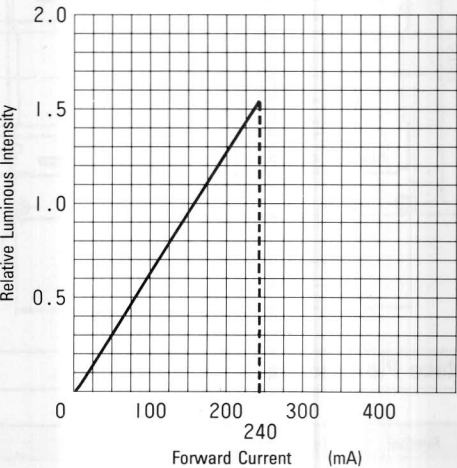
Circuit Diagram of LED Backlighting



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



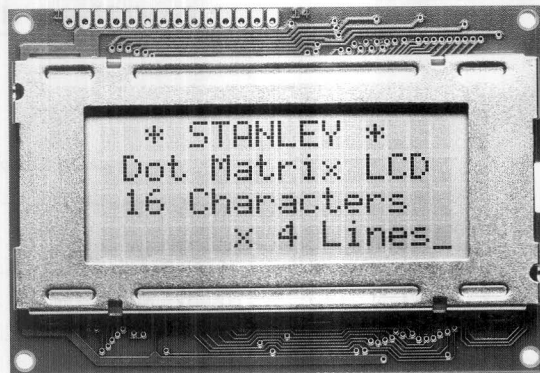
※ The ratings and characteristics of LED modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

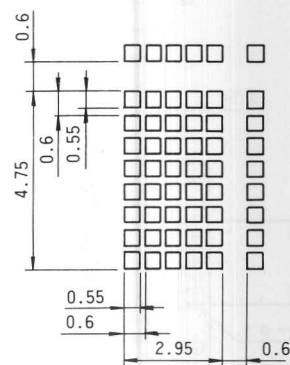
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Note) Above specifications should be applicable to the LED backlighting itself.

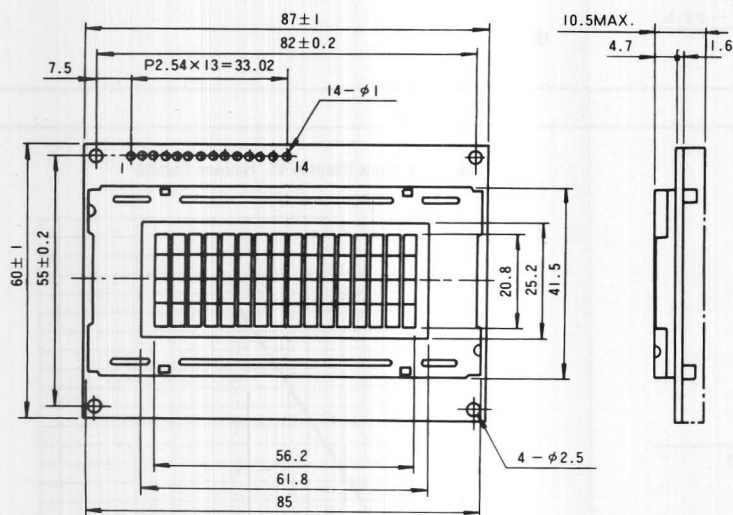
GMD1640A 16 Characters × 4 Lines 1/16 Duty



● Display Pattern



● Module Dimensions (Reflective)



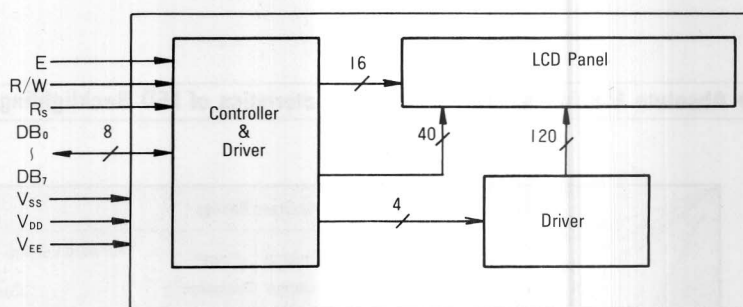
Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function	
1	V _{SS}	—	Power Supply	0V (GND)
2	V _{DD}	—		+5V
3	V _{EE}	—		for Liquid Crystal driving
4	R _S	H/L	Register select H: Data Input L: Instruction Input	
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)	
6	E	H, H ← L	Operation start signal for data read/write	
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.	
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
*15	A (LED+)	—	Supply Voltage for LED Backlighting	
*16	K (LED-)	—	0V (GND)	

(Note) * marked pins are only for LED backlighting type.

● Block Diagram



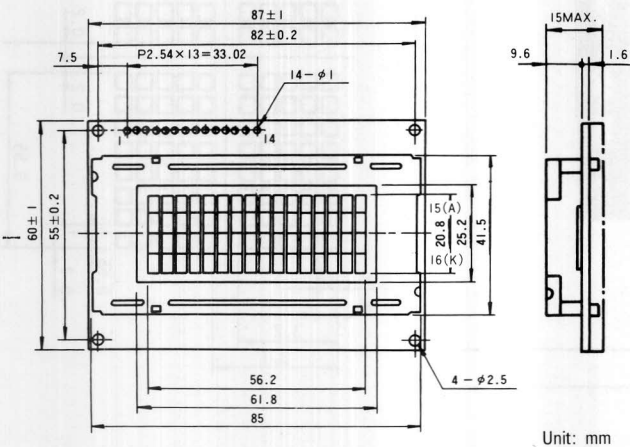
● DD RAM Address

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Line 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
Line 3	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
Line 4	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F

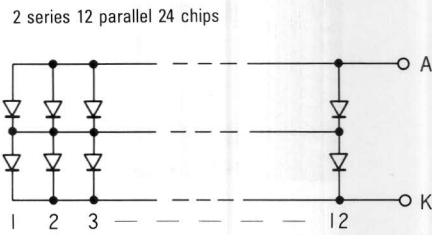
RAM area: 00 H ~ 27 H & 40 H ~ 67 H

GMD1640AL* With LED BACKLIGHTING

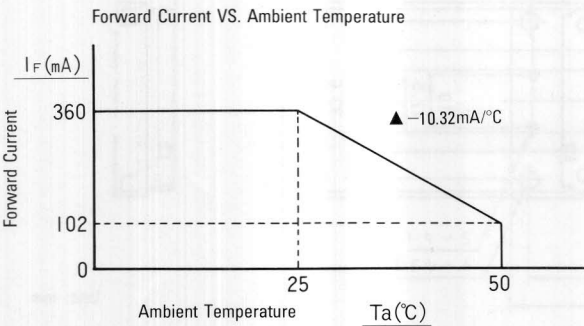
Module Dimensions (With LED BACKLIGHTING)



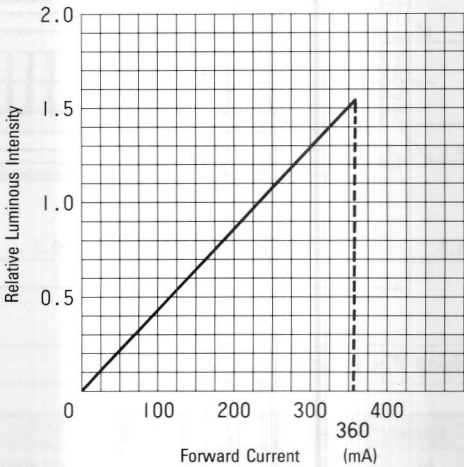
Circuit Diagram of LED Backlighting



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

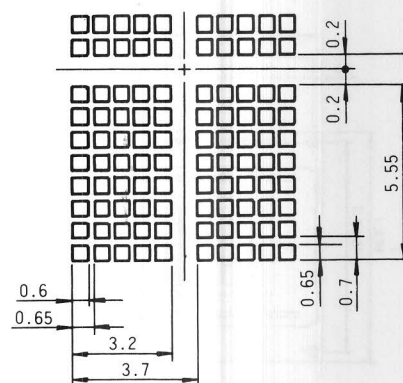
Ta = 25°C														
Part Number	Item		Absolute Maximum Ratings			Electrical and Optical Characteristics								
			Forward Current	Reverse Voltage	Power Dissipation	Forward Voltage		Reverse Current		Luminous Intensity		Peak Wavelength		
						Condition	Condition	Condition	Condition	Condition	Condition			
												I _F	V _R	P _d
	*Emitted Color	LED Chip	Max.	Max.	Max.	Typ.	Max.	—	Max.	—	Typ.	—	Typ.	—
GMD 1640AL*	R (Red)	VR	360	8	1580	4.1	4.4	240	8	65	240	630	240	
	O (Orange)	AA			1580	4.1	4.4			240		60		605
	AY (Yellow)	AY			1690	4.4	4.7			240		40		580
	Y (Yellow)	PY			1660	4.3	4.6			240		85		570
	G (Green)	PG			1660	4.3	4.6			240		60		560
Unit			mA	V	mW	V		mA	μA	V	cd/m ²	mA	nm	mA

Note) Above specifications should be applicable to the LED backlighting itself.

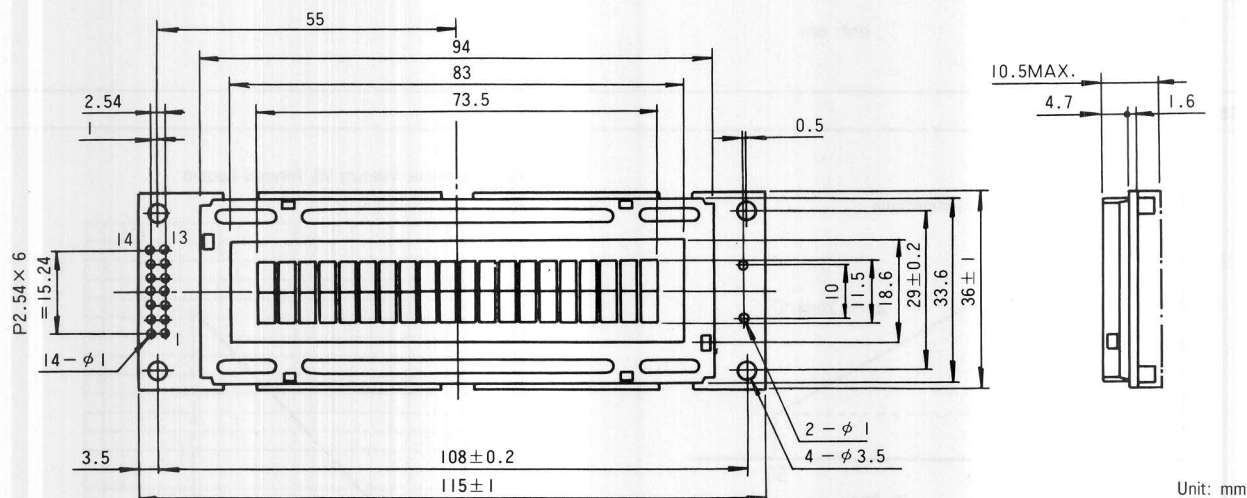
GMD2020A 20 Characters × 2 Lines 1/16 Duty



● Display Pattern



● Module Dimensions (Reflective)

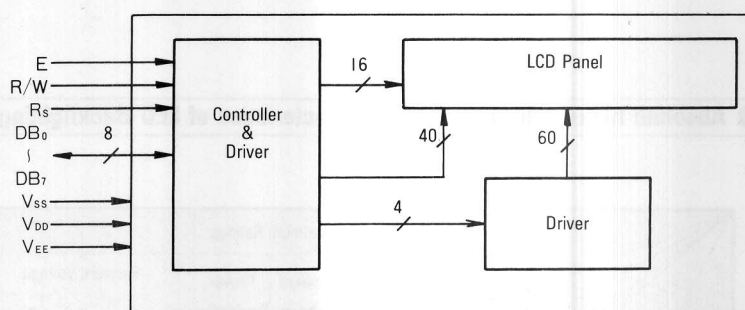


● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB ₀	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB ₁	H/L	
9	DB ₂	H/L	
10	DB ₃	H/L	
11	DB ₄	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB ₅	H/L	
13	DB ₆	H/L	
14	DB ₇	H/L	
*15	A (LED+)	—	Supply Voltage for LED Backlighting
*16	K (LED-)	—	OV (GND)

Note) * marked pins are only for LED backlighting type.

● Block Diagram



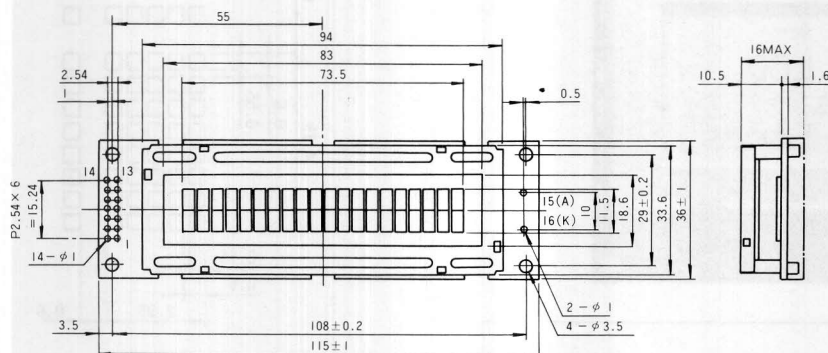
● DD RAM Address

	1	2	3	4	5	6	.....	15	16	17	18	19	20
Line 1	00	01	02	03	04	05		0E	0F	10	11	12	13
Line 2	40	41	42	43	44	45		4E	4F	50	51	52	53

RAM area: 00 H ~ 27 H & 40 H ~ 67 H

GMD2020AL* With LED BACKLIGHTING

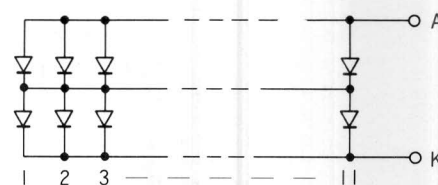
● Module Dimensions (With LED BACKLIGHTING)



Unit: mm

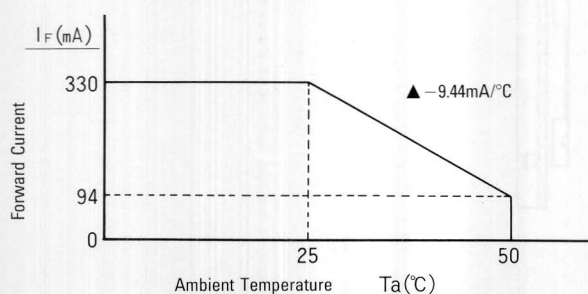
● Circuit Diagram of LED Backlighting

- 2 series 11 parallel 22 chips



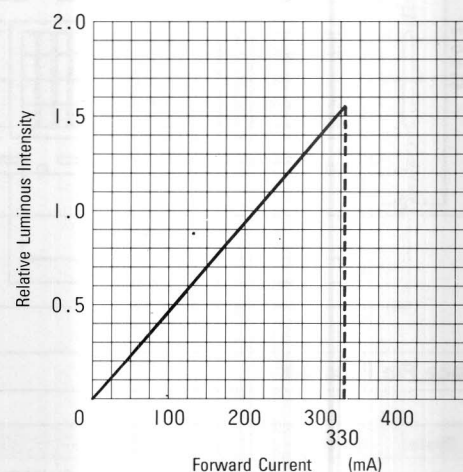
● Characteristics of LED Backlighting

Forward Current VS. Ambient Temperature



※ The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Relative Luminous Intensity VS. Forward Current



● Absolute Maximum Ratings and Characteristics of LED Backlighting

 $T_a = 25^\circ\text{C}$

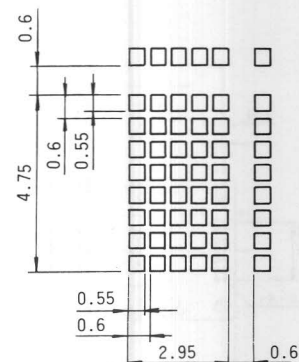
Part Number *Emitted Color LED Chip			Item Symbol	Absolute Maximum Ratings			Electrical and Optical Characteristics								
				Forward Current	Reverse Voltage	Power Dissipation	Forward Voltage			Reverse Current		Luminous Intensity		Peak Wavelength	
								Condition		Condition		Condition		Condition	
															I _F
Max.			Max.	Max.	Max.	Typ.	Max.	—	Max.	—	Typ.	—	Typ.	—	
GMD 2020AL*	R	(Red)	VR	330	8	1450	4.1	4.4	220	220	8	65	220	630	220
	O	(Orange)	AA			1450	4.1	4.4		220		60		605	
	AY	(Yellow)	AY			1550	4.4	4.7		220		40		580	
	Y	(Yellow)	PY			1520	4.3	4.6		220		85		570	
	G	(Green)	PG			1520	4.3	4.6		220		60		560	
Unit				mA	V	mW	V		mA	μA	V	cd/m ²	mA	nm	mA

Note) Above specifications should be applicable to the LED backlighting itself.

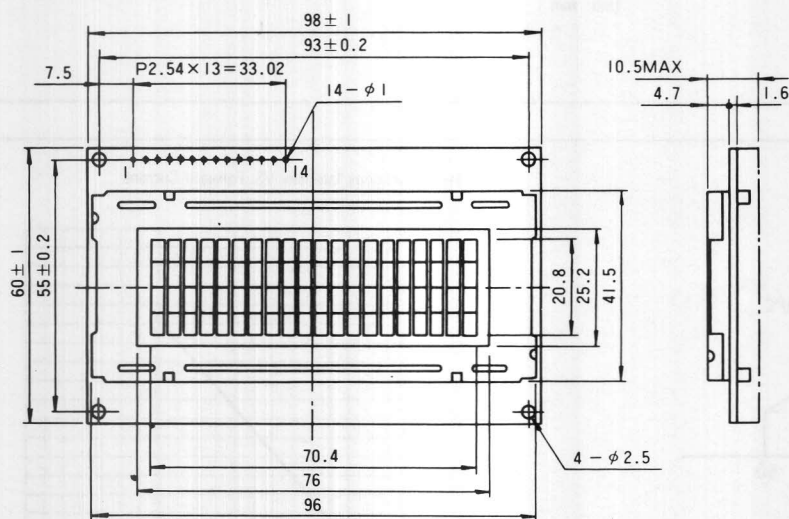
GMD2040A 20 Characters × 4 Lines 1/16 Duty



● Display Pattern



● Module Dimensions (Reflective)



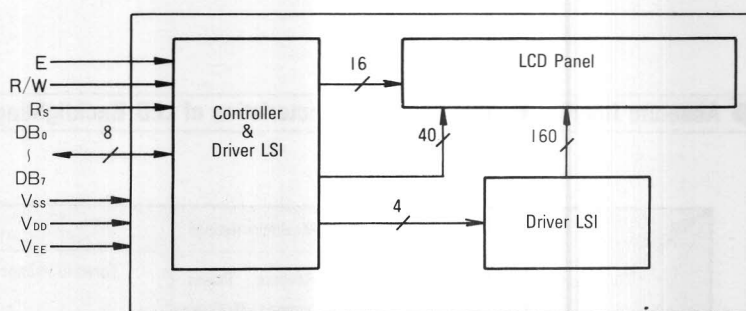
Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function	
1	V _{SS}	—	Power Supply	0V (GND)
2	V _{DD}	—		+ 5V
3	V _{EE}	—		for Liquid Crystal driving
4	R _S	H/L	Register select H: Data Input L: Instruction Input	
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)	
6	E	H, H ← L	Operation start signal for data read/write	
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.	
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
*15	A (LED+)	—	Supply Voltage for LED Backlighting	
*16	K (LED-)	—	0V (GND)	

Note) * marked pins are only for LED backlighting type.

● Block Diagram



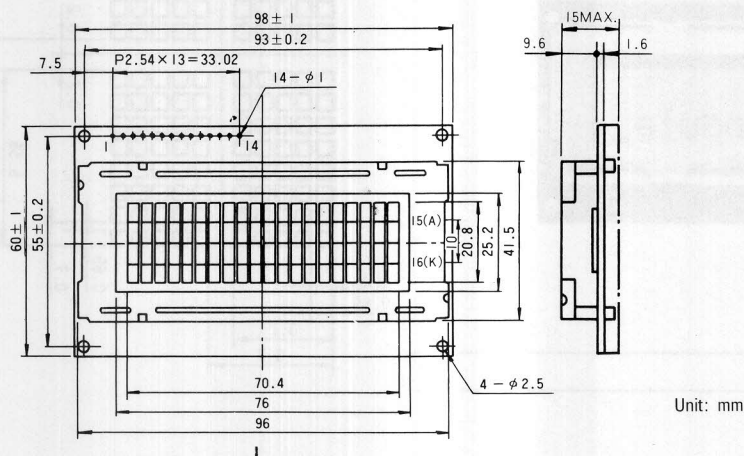
● DD RAM Address

	1	2	3	4	5	6	.....	15	16	17	18	19	20
Line 1	00	01	02	03	04	05		0E	0F	10	11	12	13
Line 2	40	41	42	43	44	45		4E	4F	50	51	52	53
Line 3	14	15	16	17	18	19		22	23	24	25	26	27
Line 4	54	55	56	57	58	59		62	63	64	65	66	67

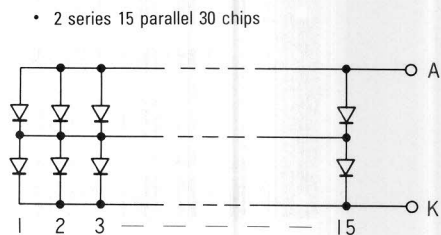
RAM area: 00 H ~ 27 H & 40 H ~ 67 H

GMD2040AL * With LED BACKLIGHTING

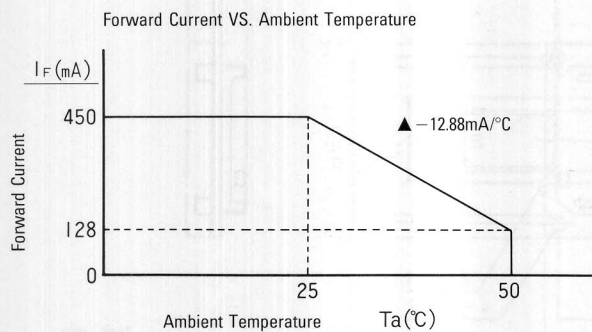
Module Dimensions (With LED BACKLIGHTING)



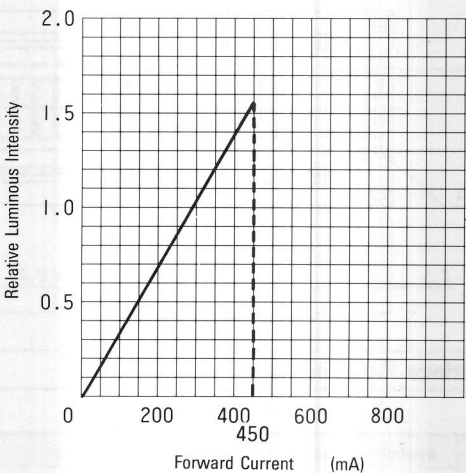
Circuit Diagram of LED Backlighting



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



※ The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

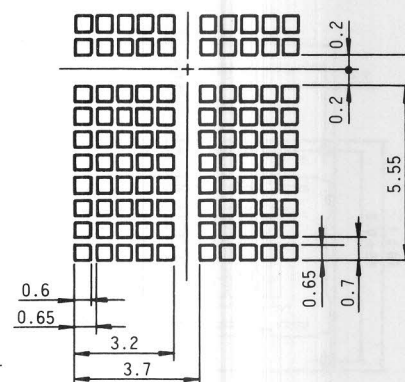
Item			Absolute Maximum Ratings			Electrical and Optical Characteristics							
			Forward Current	Reverse Voltage	Power Dissipation	Forward Voltage		Reverse Current		Luminous Intensity		Peak Wavelength	
			I_F	V_R	P_d	V_F		I_R		I_v		λ_p	
			Max.	Max.	Max.	Typ.	Max.	Max.	Max.	Typ.	Max.	Typ.	Max.
Part Number	*Emitted Color	LED Chip											
GMD 2040AL*	R (Red)	VR	450	8	1980	4.1	4.4	300	8	65	300	630	300
	O (Orange)	AA			1980	4.1	4.4			60		605	
	AY (Yellow)	AY			2120	4.4	4.7			40		580	
	Y (Yellow)	PY			2070	4.3	4.6			85		570	
	G (Green)	PG			2070	4.3	4.6			60		560	
Unit			mA	V	mW	V		mA	μA	V	cd/m^2	nm	mA

Note) Above specifications should be applicable to the LED backlighting itself.

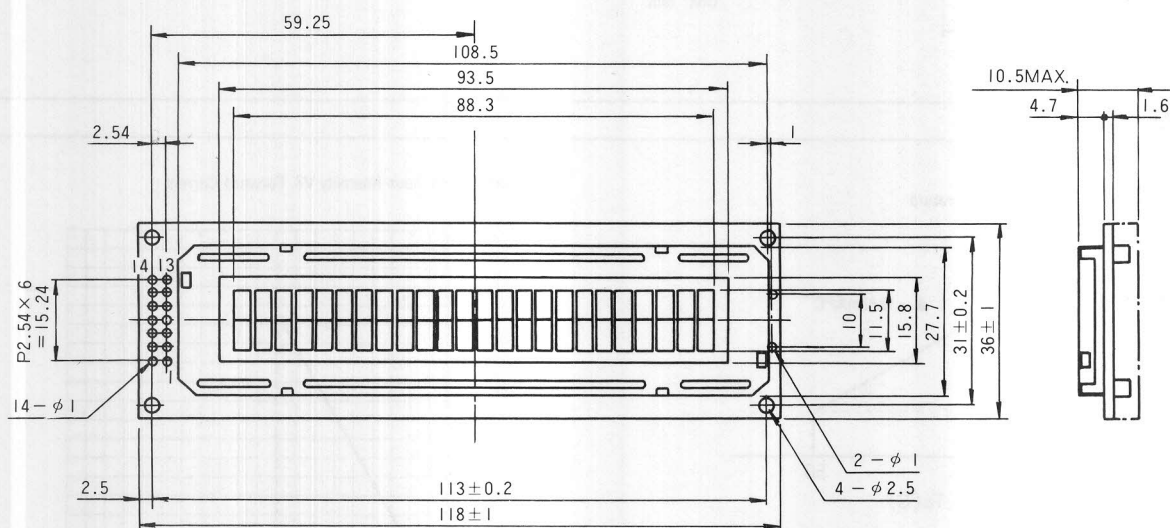
GMD2420A 24 Characters × 2 Lines 1/16 Duty



● Display Pattern



● Module Dimensions (Reflective)

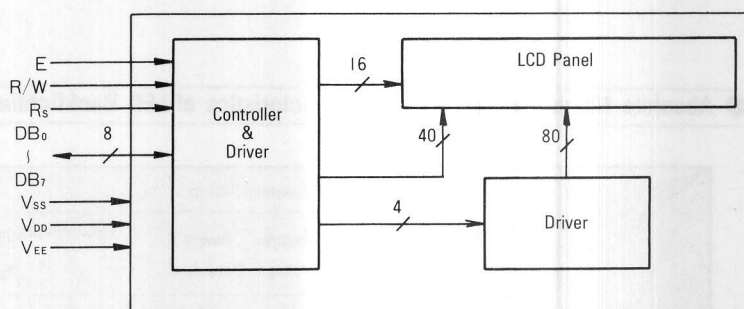


Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply 0V (GND) + 5V for Liquid Crystal driving
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
*15	A (LED+)	—	Supply Voltage for LED Backlighting
*16	K (LED-)	—	0V (GND)

● Block Diagram



● DD RAM Address

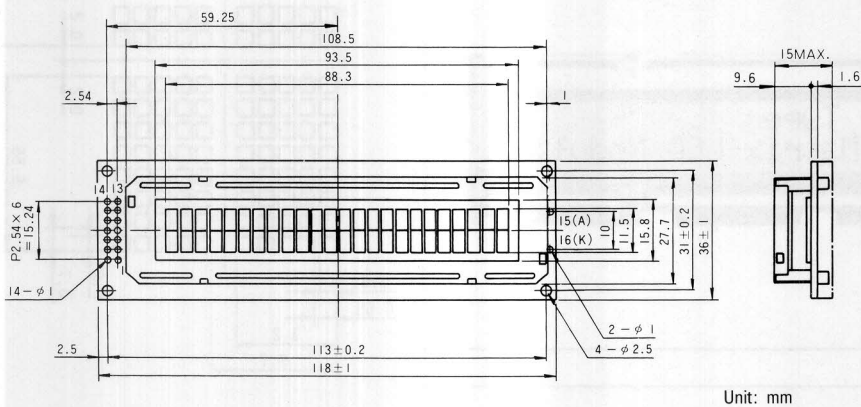
	1	2	3	4	5	6	.....	19	20	21	22	23	24
Line 1	00	01	02	03	04	05		12	13	14	15	16	17
Line 2	40	41	42	43	44	45		52	53	54	55	56	57

RAM area: 00 H ~ 27 H & 40 H ~ 67 H

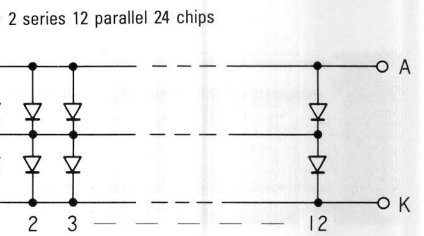
Note) * marked pins are only for LED backlighting type.

GMD2420AL* With LED BACKLIGHTING

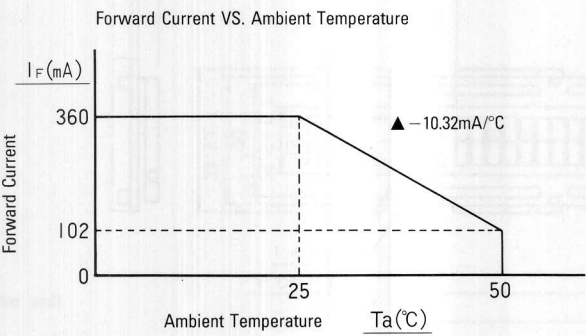
Module Dimensions (With LED BACKLIGHTING)



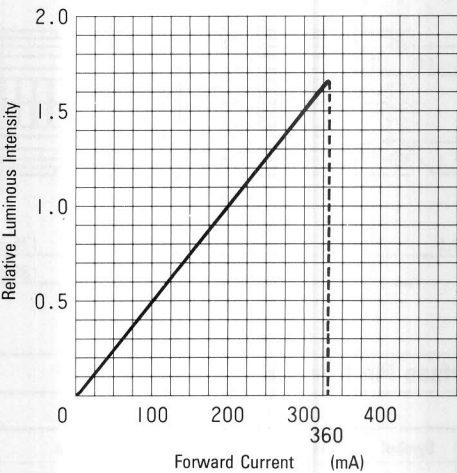
Circuit Diagram of LED Backlighting



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



※ The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

Ta = 25°C

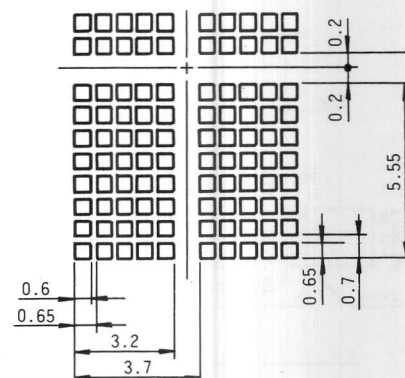
Part Number *Emitted Color LED Chip			Item Symbol	Absolute Maximum Ratings			Electrical and Optical Characteristics							
				Forward Current	Reverse Voltage	Power Dissipation	Forward Voltage		Reverse Current		Luminous Intensity		Peak Wavelength	
								Condition		Condition		Condition		Condition
Max.	Max.	Max.	Typ.	Max.	—	Max.	—	Typ.	—	Typ.	—			
GMD 2420AL*	R (Red)	VR	360	8	1580	4.1	4.4	240	240	8	65	240	630	
	O (Orange)	AA			1580	4.1	4.4		240		60		605	
	AY (Yellow)	AY			1690	4.4	4.7		240		40		580	
	Y (Yellow)	PY			1660	4.3	4.6		240		85		570	
	G (Green)	PG			1660	4.3	4.6		240		60		560	
Unit				mA	V	mW	V	mA	μA	V	cd/m ²	mA	nm	mA

Note) Above specifications should be applicable to the LED backlighting itself.

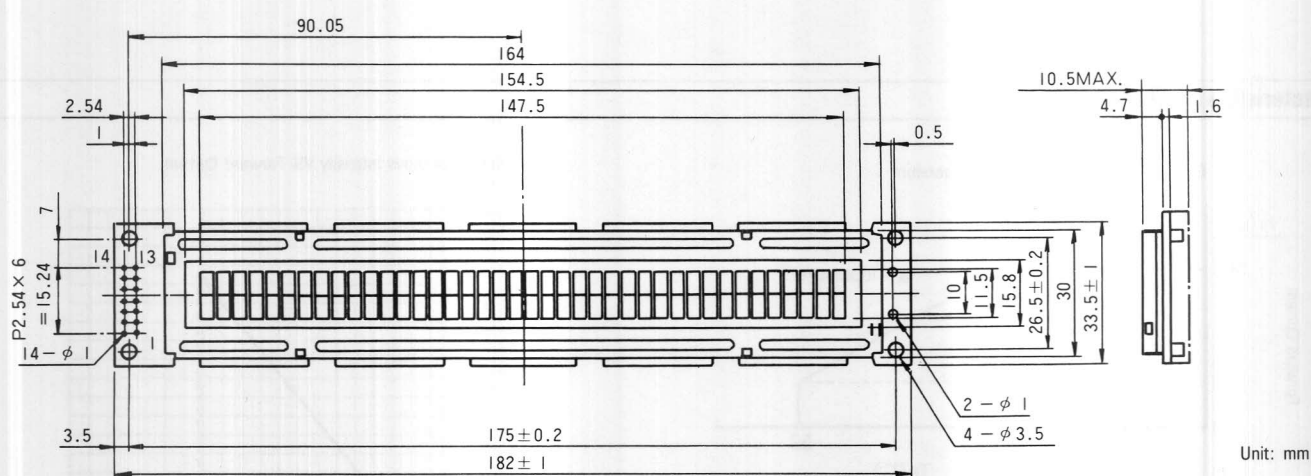
GMD4020A 40 Characters × 2 Lines 1/16 Duty



● Display Pattern



● Module Dimensions (Reflective)



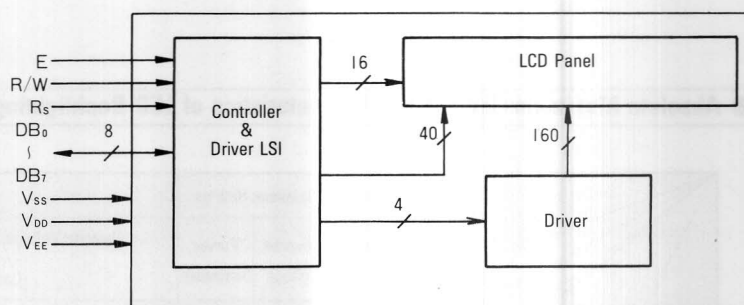
Unit: mm

● Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB ₀	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB ₁	H/L	
9	DB ₂	H/L	
10	DB ₃	H/L	
11	DB ₄	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB ₅	H/L	
13	DB ₆	H/L	
14	DB ₇	H/L	
15	NC	—	No Contact
16	NC	—	No Contact

Note) * marked pins are only for LED backlighting type.

● Block Diagram



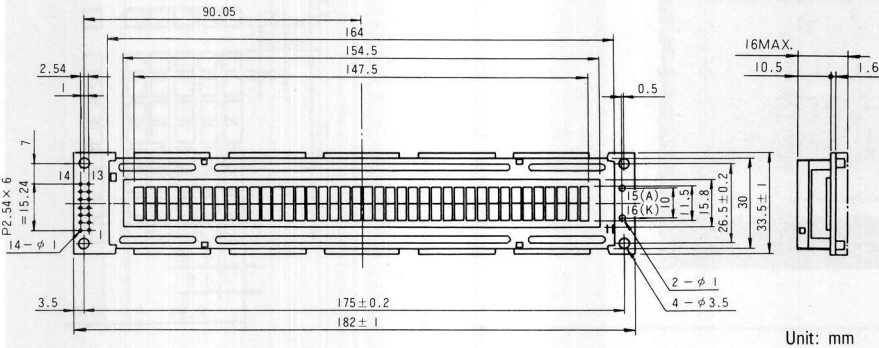
● DD RAM Address

	1	2	3	4	5	6	.....	35	36	37	38	39	40
Line 1	00	01	02	03	04	05		22	23	24	25	26	27
Line 2	40	41	42	43	44	45		62	63	64	65	66	67

RAM area: 00 H ~ 27 H & 40 H ~ 67 H

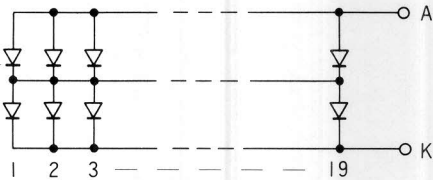
GMD4020AL * With LED BACKLIGHTING

Module Dimensions (With LED BACKLIGHTING)

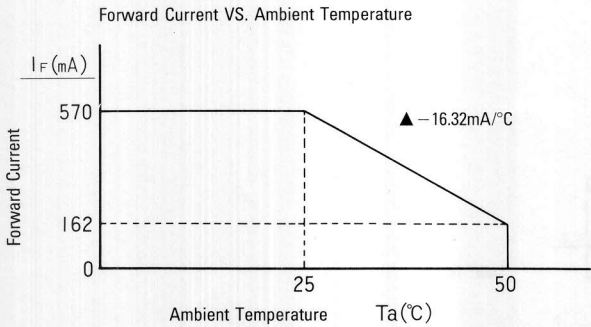


Circuit Diagram of LED Backlighting

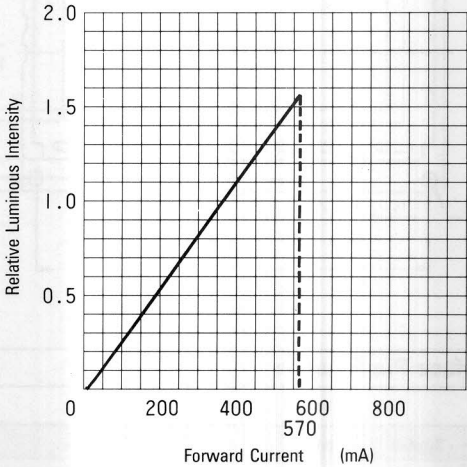
• 2 series 19 parallel 38 chips



Characteristics of LED Backlighting



Relative Luminous Intensity VS. Forward Current



※ The ratings and characteristics of LCD modules are specified with the assumption that the forward current supplied to the LED units will be varied according to the ambient temperature.

Absolute Maximum Ratings and Characteristics of LED Backlighting

Ta = 25°C

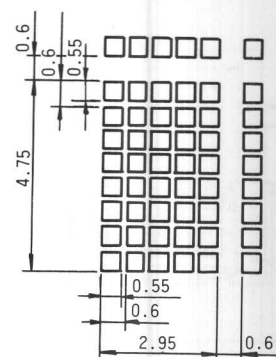
Part Number *Emitted Color LED Chip			Item Symbol	Absolute Maximum Ratings			Electrical and Optical Characteristics							
				Forward Current	Reverse Voltage	Power Dissipation	Forward Voltage		Reverse Current		Luminous Intensity		Peak Wavelength	
								Condition		Condition		Condition		Condition
			Max.	Max.	Max.	Typ.	Max.	—	Max.	—	Typ.	—	Typ.	—
GMD 4020AL*	R (Red)	VR	570	8	2510	4.1	4.4	380	380	8	65	380	630	380
	O (Orange)	AA			2510	4.1	4.4		380		60		605	
	AY (Yellow)	AY			2680	4.4	4.7		380		40		580	
	Y (Yellow)	PY			2620	4.3	4.6		380		85		570	
	G (Green)	PG			2620	4.3	4.6		380		60		560	
Unit			mA	V	mW	V		mA	μA	V	cd/m ²	mA	nm	mA

Note) Above specifications should be applicable to the LED backlighting itself.

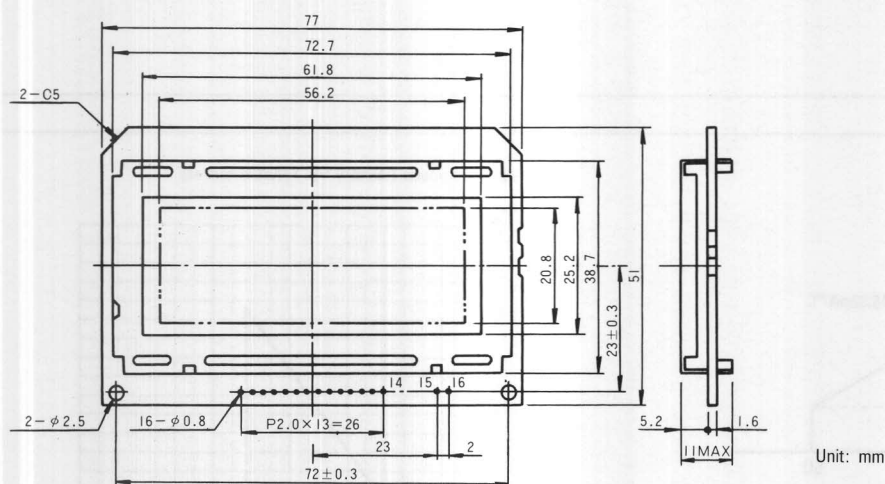
GMD1640B 16 Characters × 4 Lines 1/16 Duty



Display Pattern



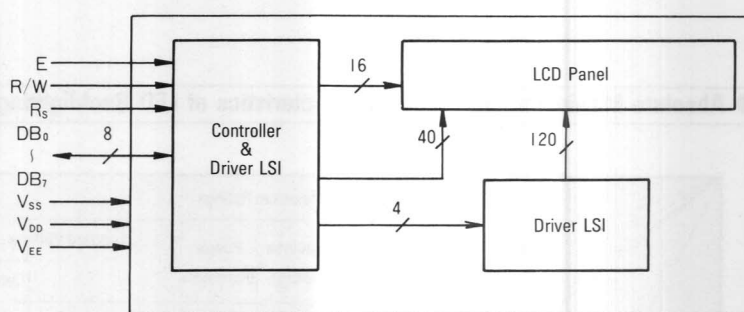
Module Dimensions (Reflective)



Interface Pin Function

Pin No.	Symbol	Level	Function
1	V _{SS}	—	Power Supply
2	V _{DD}	—	
3	V _{EE}	—	
4	R _S	H/L	Register select H: Data Input L: Instruction Input
5	R/W	H/L	H: Data Read (Module → MPU) L: Data Write (Module ← MPU)
6	E	H, H ← L	Operation start signal for data read/write
7	DB0	H/L	Lower order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. These four are not used during 4-bit operation.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	Higher order 4 lines data bus with bidirectional three-state. Used for data transfer between the MPU and the module. DB 7 can be used as a BUSY flag.
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
*15	A (LED+)	—	Supply Voltage for LED Backlighting
*16	K (LED-)	—	0V (GND)

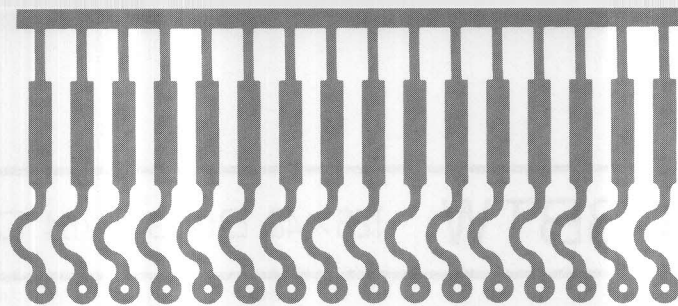
Block Diagram



DD RAM Address

	1	2	3	4	5	6	7	8	9	10	11*	12	13	14	15	16
Line 1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Line 2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
Line 3	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
Line 4	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F

RAM area: 00 H ~ 27 H & 40 H ~ 67 H



Graphic dot matrix modules

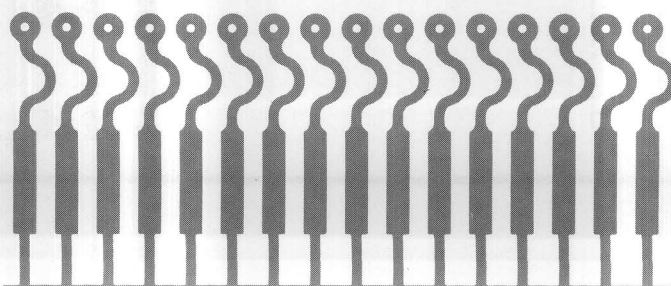
GMF Series

Features

- All types have CFL backlighting as standard
- GMF series utilizes STN (Super TN) LCD technology to provide high contrast, wide viewing angle and sharp display
- Available to display any fonts in various sizes and complexed patterns
- Wide selection from 128×48 dots to 256×128 dots
- Extremely compact size, light weight and low power consumption
- Control LSI is external. Please see page 37 for details (Except GMF12048BBTW)

Applications

- Telecommunication devices
(Telephone, Facsimile, etc.)
- OA devices
- Measuring instruments
- POS terminals
- Electronic musical instruments
- Others

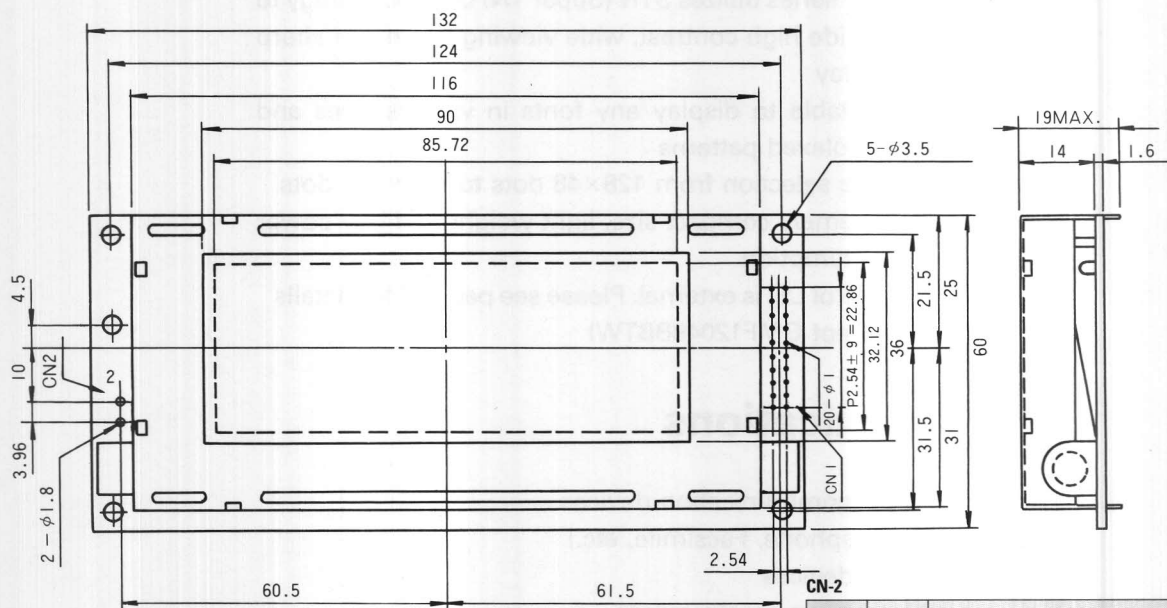


GMF12048BBTW 128×48 Dots 1/64 Duty



Module Dimensions (With CFL BACKLIGHTING)

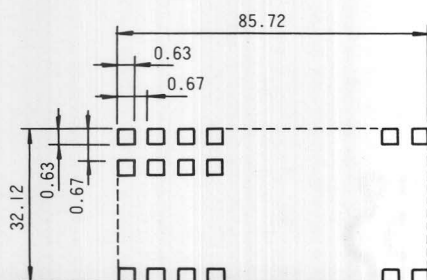
unit: mm



Pin No.	Symbol	Function	
1	CFL1	Power Supply for CFL	for Inverter "OUT" Terminal
2	CFL2		for Inverter "OUT GND" Terminal

Display Pattern

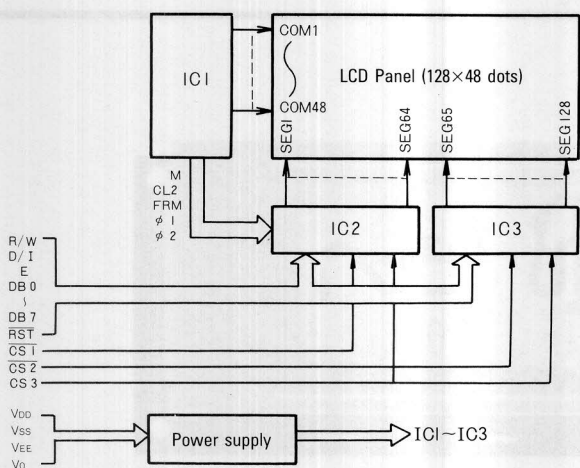
unit: mm



Data Transmission

	X1	X2	X128
Y1	DB0	DB0	DB0
Y2	DB1	DB1	DB1
Y3	DB2	DB2	DB2
Y4	DB3	DB3	DB3
Y5	DB4	DB4	DB4
Y6	DB5	DB5	DB5
Y7	DB6	DB6	DB6
Y8	DB7	DB7	DB7
Y47	DB6	DB6	DB6
Y48	DB7	DB7	DB7

● Block Diagram



Note) IC1:HD61203(Hitachi)
IC2:IC3:HD61202(Hitachi)
Please refer to the specification of HD61202(HITACHI) to design the circuit.

● Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit.
Power supply for logic	VDD-VSS	-0.3	7	V
Power supply for LCD drive	VEE	VDD-19.0	VDD+0.3	V
Operating voltage	Vo	VEE	VDD	V
Input voltage for logic	Vi	-0.3	VDD+0.3	V
Operating temperature	Top	0	40	°C
Storage temperature	Tstg	-20	60	°C

● Electrical Characteristics

(VSS=0V, VDD=4.75~5.25V, VDD-VEE=11.0~17.0V, Ta=0~+40°C)

Item	Symbol	Min.	Typ.	Max.	Unit.
Power supply for logic	VDD	4.75	5.0	5.25	V
Power supply for LCD drive	VDD-VEE	11.0	—	17.0	V
Input "High" level	VIHC	0.7VDD	—	VDD	V (1)
	VIHT	2.0	—	VDD	V (2)
Input "Low" level	VILC	0	—	0.3VDD	V (1)
	VILT	0	—	0.8	V (2)
Current Consumption (for LCD 1/48 duty)	IDD	—	3	—	mA (3)
	IEE	—	2	—	mA (3)

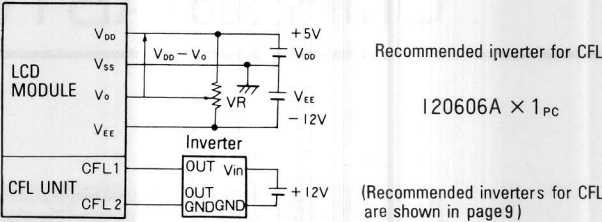
- (1) Applied to: M, FRM, CL, RST, ADC, φ1, φ2.
(2) Applied to: CS1, CS2, CS3, E, R/W, D/I, DB0 ~ DB7
(3) Above data is taken operated by 1/48 duty.

● Optional Characteristics (Please refer to Page 12 for definition of optical characteristics)

Item	Symbol	Min.	Typ.	Max.	Unit.	Ta	Condition
Operating Voltage for LCD (1/48 duty)	VDD-Vo	—	12.7	—	V	40°C	φ=0° θ=0°
		—	13.4	—	V	25°C	φ=0° θ=0°
		—	14.5	—	V	0°C	φ=0° θ=0°
Response time rise	tr	—	250	350	ms	25°C	φ=0° θ=0° *1
Response time fall	td	—	250	350	ms	25°C	φ=0° θ=0° *1
Contrast Ratio	K	2.5	—	—	—	25°C	φ=0° θ=0° *2
Viewing Angle	φ1-φ2	40	—	—	degree	25°C	φ=0° K>1.4 *3
	θ	±130	—	—	degree	25°C	φ=20° K>1.4 *3

* measured on LCD only
Recommended controller LSI: Interface with CPU directly
Note) Please refer to the specification of HD61202(HITACHI) to design the circuit.

● Example of power supply circuit



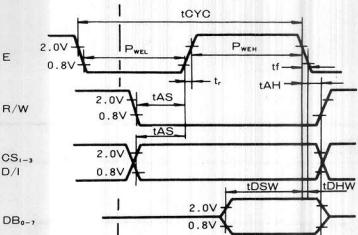
● Interface Pin Function

Pin No.	Symbol	Function
1	CS1	Chip Selection
2	CS2	At Select IC2: CS1 = L, CS3 = H
3	CS3	At Select IC3: CS2 = L, CS3 = H
4	R/W	Data can be input or output when CS3 = H
5	D/I	R/W = H: Data appears at DB0 to DB7 can be read by the CPU, When E = H, CS1, CS2 = L, and CS3 = H, R/W = L, DB0 to DB7 can accept at fall of E when CS1, CS2 = L, CS3 = H.
6	E	D/I = H: Indicates that the data of DB0 to DB7 is display data, D/I = L: Indicates that the data of DB0 to DB7 is display control data.
7	DB0	Data bus, three-state I/O common terminal.
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	RST	Reset RST = L: Reset
16	N.C.	No Contact
17	VDD	for Logic (+5V)
18	VSS	GND (0V)
19	VEE	for LCD Driver Logic (-12V)
20	Vo	Operating Voltage for LCD Driving (VCC ≥ VOP ≥ VEE)

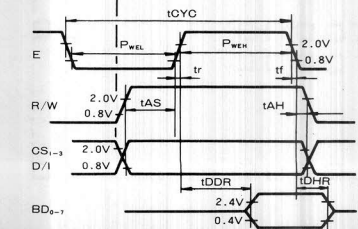
● Interface Timing Chart

Item	Symbol	Min.	Typ.	Max.	Unit
E cycle time	tCYC	1000	—	—	ns
E pulse width (H level)	PWEH	450	—	—	ns
E pulse width (L level)	PWEL	450	—	—	ns
E rise time	tr	—	—	25	ns
E fall time	tf	—	—	25	ns
Address set up time	tAS	140	—	—	ns
Address hold time	tAH	10	—	—	ns
Data set up time	tDSH	200	—	—	ns
Data delay time	tDDR	—	—	320	ns
Data hold time (write)	tDHM	10	—	—	ns
Data hold time (read)	tDHR	20	—	—	ns

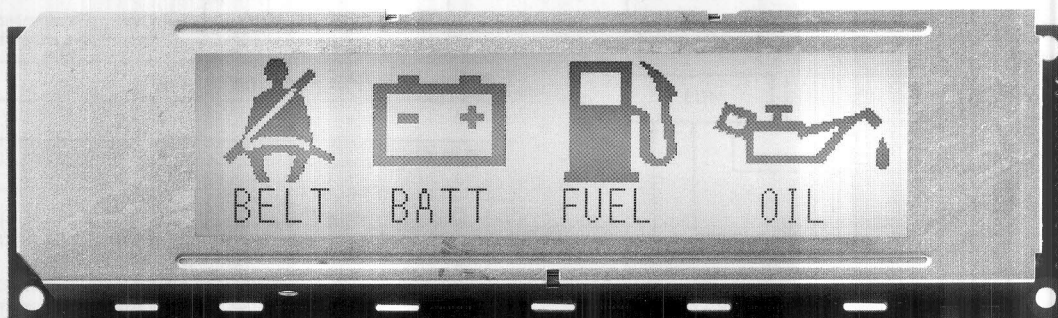
■ CPU Write Timing Chart



■ CPU Read Timing Chart

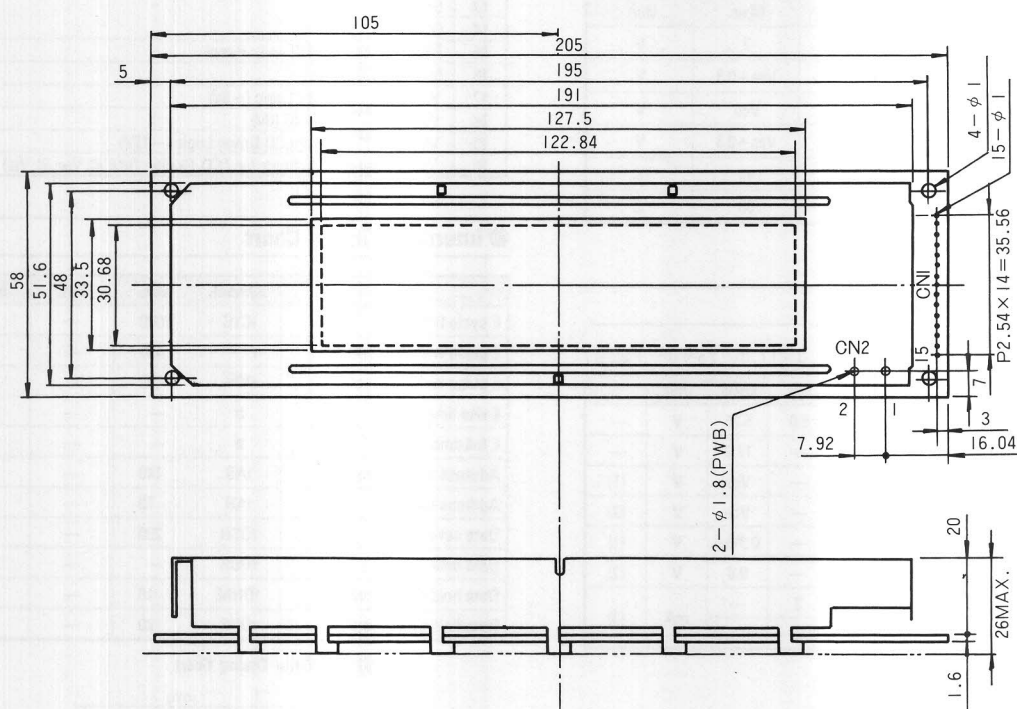


GMF25064ABTW 256×64 Dots 1/64 Duty



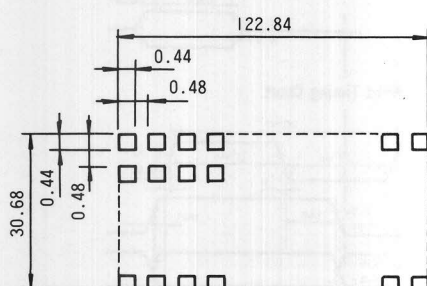
● Module Dimensions (With CFL BACKLIGHTING)

unit: mm



● Display Pattern

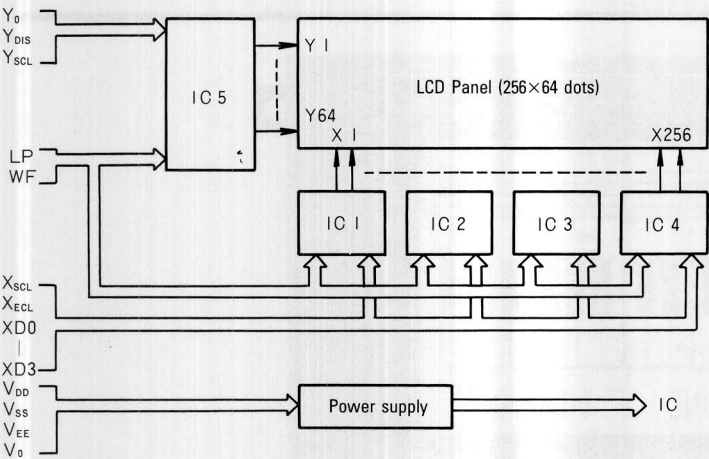
unit: mm



● Data Transmission

	X1	X2	X3	X4	X5	X6	X7	X8	-----	X253	X254	X255	X256	
Y 1	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3			XD0	XD1	XD2	XD3
Y 2	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3			XD0	XD1	XD2	XD3
...														
Y64	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3			XD0	XD1	XD2	XD3

● Block Diagram



● Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit.
Power supply for logic	VDD-VSS	0	7.0	V
Power supply for LCD drive	VDD-VEE	0	28.0	V
Power supply for LCD drive logic	VDD-V0	0	VDD-VEE	V
Input voltage	Vi	VSS	VDD+0.3	V
Operating temperature	Top	0	40	°C
Storage temperature	Tstg	-20	60	°C

● Electrical Characteristics

$V_{DD}-V_{SS}=5V\pm0.5V$, $V_{DD}-V_{EE}=15V\pm0.5V$, $T_a=25^{\circ}C$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply for logic	VDD	—	4.5	5.0	5.5	V
Power supply for LCD drive	VDD-VEE	—	15.0	—	25.0	V
Input logic "High" level	VIH	—	0.8VDD	—	VDD+0.3	V
Input logic "Low" level	VIL	—	VSS-0.3	—	0.2VDD	V
Current Consumption for logic	IDD	—	—	2.5	6	mA
for LCD drive	IO	—	—	0.5	2	mA

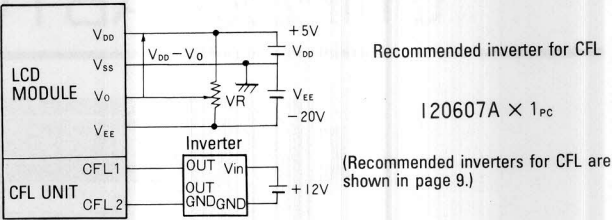
● Optional Characteristics (Please refer to page 12 for the definition of optical characteristics.)

$V_{DD}-V_0=12.7V$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.
Operating Voltage for LCD (1/64 duty)	V _{DD} -V ₀	Ta = 0°C	—	13.7	—	V
		Ta = 25°C	—	12.7	—	V
		Ta = 40°C	—	11.8	—	V
Viewing Angle	$\phi 1 \sim \phi 2$	$\theta = 0^{\circ}$ K=2.0 *2	40	—	—	degree
	θ	$\phi = 20^{\circ}$ K=2.0 *1	± 130	—	—	degree
Contrast Ratio	K	Ta=25°C	*3	2.8	3.1	—
Response time rise	τ_r	$\phi = 20^{\circ}C$	*4	—	250	350 ms
Response time fall	τ_d	$\theta = 0^{\circ}C$	*4	—	250	350 ms

Measured on LCD only
Recommended controller LSI: E-1330 (SEIKO EPSON).

● Example of power supply circuit



● Interface Pin Function

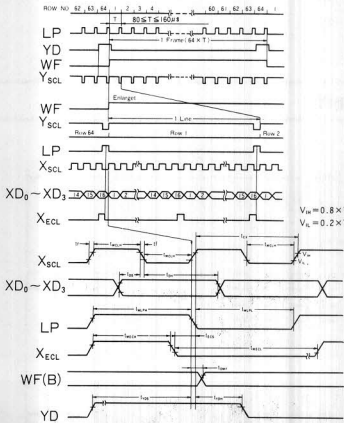
Pin No.	Symbol	Function
1	VDD	Power supply for logic (+5V)
2	VSS	GND (0V)
3	V0	Operating voltage for LC driving
4	LP	Display data latch pulse
5	WF	AC drive signal
6	Ydis	H: display ON, L: display OFF
7	YSCL	Scan shift clock usually open
8	YD	Scan start pulse
9	XSCL	Display data shift clock
10	XECL	X driver enable chain clock
11	XD0	DATA 0 "H"...ON, "L"...OFF
12	XD1	DATA 1 "H"...ON, "L"...OFF
13	XD2	DATA 2 "H"...ON, "L"...OFF
14	XD3	DATA 3 "H"...ON, "L"...OFF
15	VEE	Power supply for operating LCD (-20V)

Pin No.	Symbol	Function
1	CFL1	Power supply for Inverter "OUT" Terminal
2	CFL2	for CFL for Inverter "OUT GND" Terminal

● Interface Timing Chart

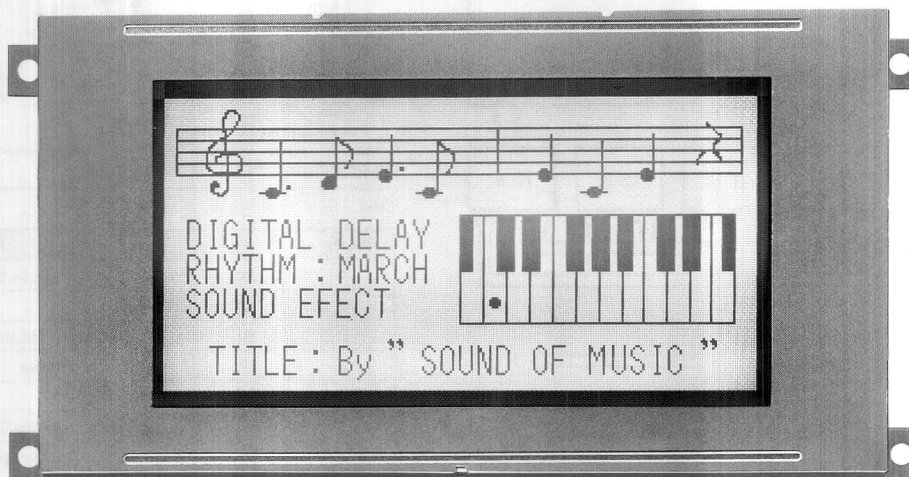
$V_{DD}-V_{SS}=5V\pm10\%$

Item	Symbol	Min.	Max.	Unit
Clock frequency (XSCL)	fXSCL	—	6	MHz
Shift clock pulse width (H level)	tWCLH	63	—	ns
Shift clock pulse width (L level)	tWCLL	63	—	ns
Enable clock pulse width (H level)	tWECH	100	—	ns
Enable clock pulse width (L level)	tWECL	100	—	ns
Latch panel pulse width (H level)	tWLPH	160	—	ns
Latch panel pulse width (L level)	tWLPL	220	—	ns
Enable clock set up time	tECS	70	—	ns
Data set up time	tDS	50	—	ns
Data hold time	tDH	30	—	ns
Y data set up time	tYDS	100	—	ns
Y data hold time	tYDH	30	—	ns
Clock set up time	tLT	100	—	ns
WF duration time	tDWF	-500	500	ns
Rise and fall time	tr.tf	—	50	ns
Latch pulse time	T	80	160	μs



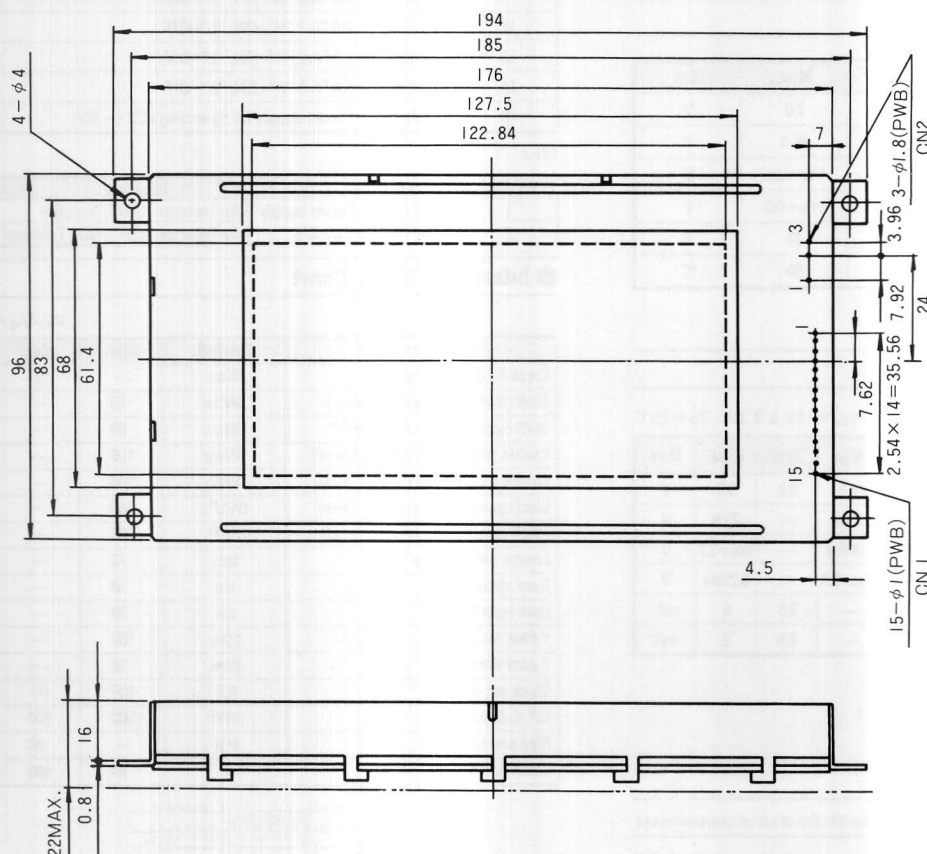
GMF25012ABTW

256×128 Dots 1/128 Duty



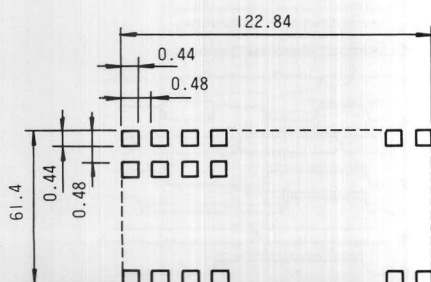
● Module Dimensions (With CFL BACKLIGHTING)

unit: mm



● Display Pattern

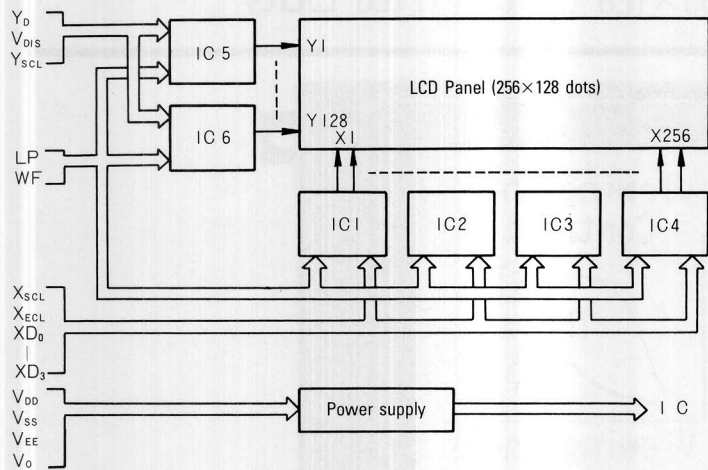
unit: mm



● Data Transmission

	X1	X2	X3	X4	X5	X6	X7	X8		X253	X254	X255	X256
Y 1	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3		XD0	XD1	XD2	XD3
Y 2	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3		XD0	XD1	XD2	XD3
Y64	XD0	XD1	XD2	XD3	XD0	XD1	XD2	XD3		XD0	XD1	XD2	XD3

● Block Diagram



● Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit.
Power supply for logic	V _{DD} -V _{SS}	0	7.0	V
Power supply for LCD drive	V _{DD} -V _O	0	28.0	V
Input Voltage	V _I	V _{SS}	V _{DD} +0.3	V
Operating temperature	T _{op}	0	40	°C
Storage temperature	T _{stg}	-20	60	°C

● Electrical Characteristics

$V_{DD} - V_{SS} = 5V \pm 0.5V, T_a = 25^\circ C$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply for logic	V _{DD}	—	4.5	5.0	5.5	V
Input logic "High" level	V _{IH}	—	0.8V _{DD}	—	V _{DD} +0.3	V
Input logic "Low" level	V _{IL}	—	V _{SS} -0.3	—	0.2V _{DD}	V
Current Consumption for logic	I _{DD}	—	—	15	—	mA
for LCD drive	I _O	—	—	14	—	mA

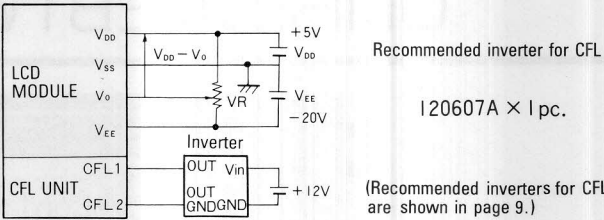
● Optional Characteristics (Please refer to page 12 for the definition of optical characteristics.)

$V_{DD} - V_O = 17.6V$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.
Operating Voltage for LCD (1/128 duty)	V _{DD} -V _O	T _a = 0°C	—	18.8	—	V
		T _a = 25°C	—	17.6	—	V
		T _a = 40°C	—	16.5	—	V
Viewing Angle	ϕ 1 ~ ϕ 2	$\theta = 0^\circ$ K=2.4 *2	40	—	—	degree
		$\phi = 20^\circ$ K=2.4 *1	± 100	—	—	degree
Contrast Ratio	K	T _a =25°C	*3	2.7	3.0	—
Response time rise	τ_r	$\phi = 20^\circ$ C	*4	—	300	400 ms
Response time fall	τ_d	$\theta = 0^\circ$ C	*4	—	300	400 ms

Measured on LCD only
Recommended controller LSI: E-1330 (SEIKO EPSON).

● Example of power supply circuit



● Interface Pin Function

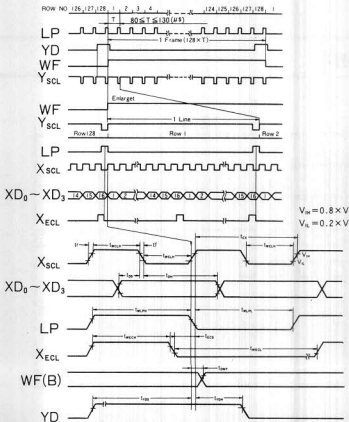
Pin No.	Symbol	Function
1	V _{DD}	Power supply for logic (+5V)
2	V _{SS}	GND (0V)
3	V _O	Operating voltage for LC driving
4	LP	Display data latch pulse
5	WF	AC drive signal
6	Y _{DIS}	H: display ON, L: display OFF
7	Y _{SCL}	Scan shift clock usually open
8	Y _D	Scan start pulse
9	X _{SCL}	Display data shift clock
10	X _{ECL}	X driver enable chain clock
11	X _{D0}	DATA 0 "H"---ON, "L"---OFF
12	X _{D1}	DATA 1 "H"---ON, "L"---OFF
13	X _{D2}	DATA 2 "H"---ON, "L"---OFF
14	X _{D3}	DATA 3 "H"---ON, "L"---OFF
15	V _{EE}	Power supply for operating LCD (-20V)

Pin No.	Symbol	Function
1	CFL1	Power supply for Inverter "OUT GND" Terminal
2	NC	No contact
3	CFL2	Power supply for Inverter "OUT" Terminal

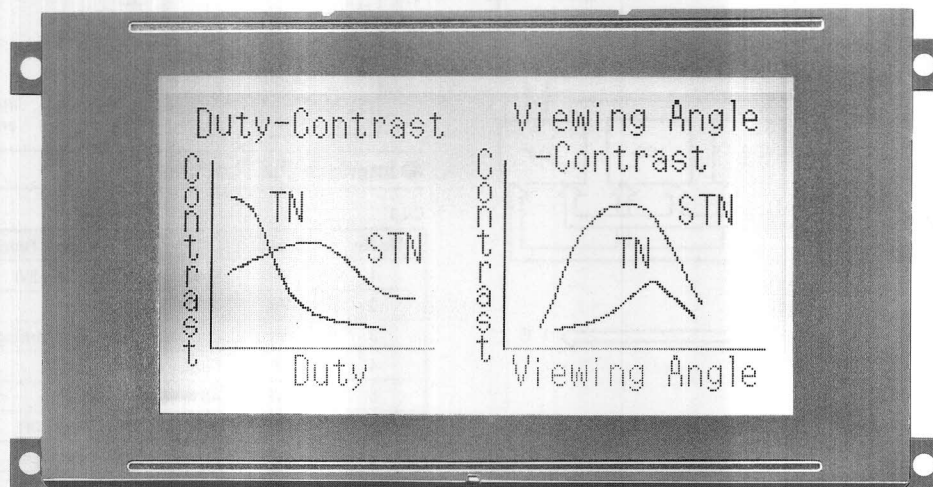
● Interface Timing Chart

$V_{DD} - V_{SS} = 5V \pm 10\%$

Item	Symbol	Min.	Max.	Unit
Clock frequency (X _{SCL})	f _{XSCL}	—	6	MHz
Shift clock pulse width (H level)	t _{WCLH}	63	—	ns
Shift clock pulse width (L level)	t _{WCLL}	63	—	ns
Enable clock pulse width (H level)	t _{WECH}	100	—	ns
Enable clock pulse width (L level)	t _{WECL}	100	—	ns
Latch panel pulse width (H level)	t _{WLPH}	160	—	ns
Latch panel pulse width (L level)	t _{WLPL}	220	—	ns
Enable clock set up time	t _{ECS}	70	—	ns
Data set up time	t _{DS}	50	—	ns
Data hold time	t _{DH}	30	—	ns
Y data set up time	t _{YDS}	100	—	ns
Y data hold time	t _{YDH}	30	—	ns
Clock set up time	t _{LT}	100	—	ns
WF duration time	t _{WF}	-500	500	ns
Rise and fall time	t _{r,tf}	—	50	ns
Latch pulse time	T	80	130	μs

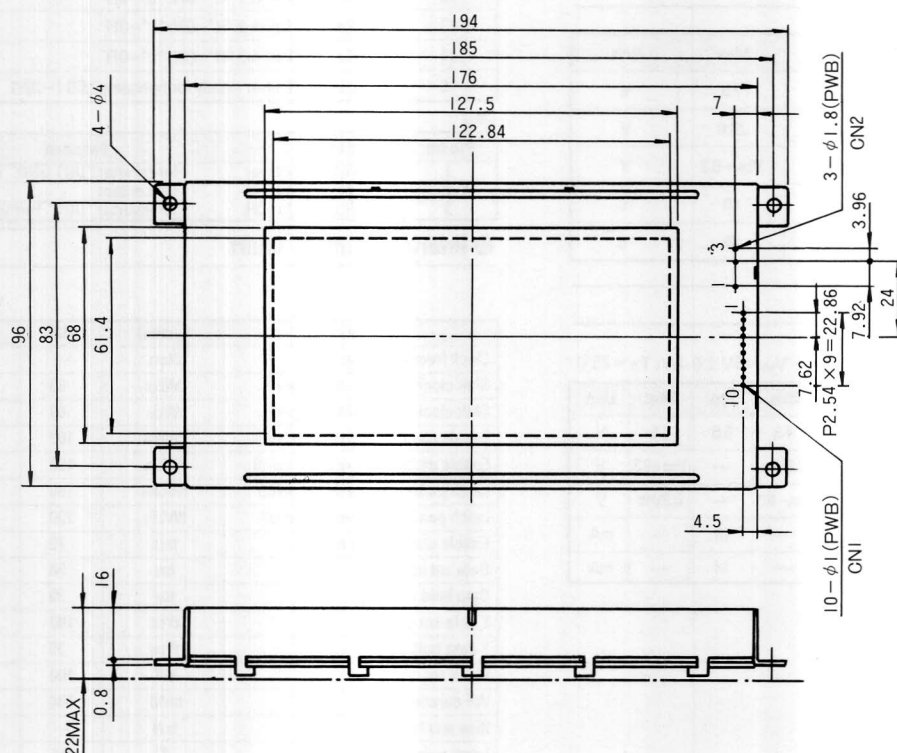


GMF25012EBTW 256×128 Dots 1/128 Duty



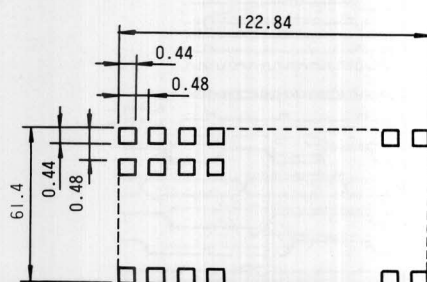
Module Dimensions (With CFL BACKLIGHTING)

unit: mm

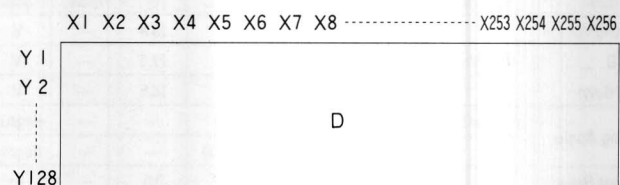


Display Pattern

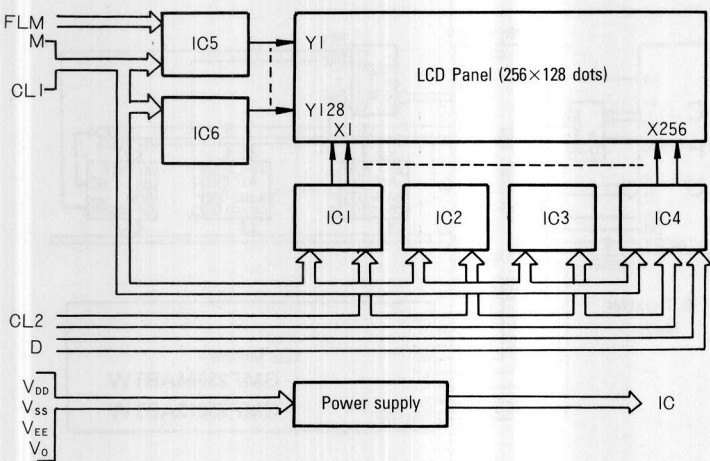
unit: mm



Data Transmission



● Block Diagram



● Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit.
Power supply for logic	$V_{DD}-V_{SS}$	0	7.0	V
Power supply for LCD drive	$V_{DD}-V_0$	0	28.0	V
Input Voltage	V_I	V_{SS}	$V_{DD}+0.3$	V
Operating temperature	T_{op}	0	40	°C
Storage temperature	T_{stg}	-20	60	°C

● Electrical Characteristics

($V_{DD}-V_{SS}=5V\pm0.5V$, $T_a=25^\circ C$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply for logic	V_{DD}	—	4.5	5.0	5.5	V
Input logic "High" level	V_{IH}	—	$0.5V_{DD}$	—	$V_{DD}+0.3$	V
Input logic "Low" level	V_{IL}	—	$V_{SS}-0.3$	—	$0.2V_{DD}$	V
Current Consumption for logic	I_{DD}	—	—	15	—	mA
for LCD drive	I_{EE}	—	—	14	—	mA
Power supply for LCD drive	V_0	—	-20	—	-9	V

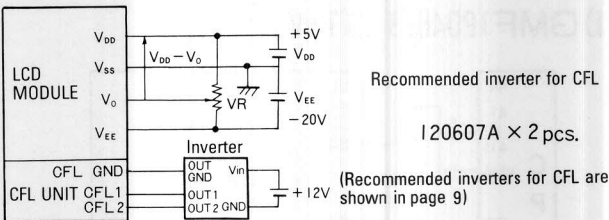
● Optional Characteristics (Please refer to page 12 for the definition of optical characteristics.)

($V_{DD}-V_0=17.6V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.
Operating Voltage for LCD (1/128 duty)	$V_{DD}-V_0$	$T_a=0^\circ C$	—	18.8	—	V
		$T_a=25^\circ C$	—	17.6	—	V
		$T_a=40^\circ C$	—	16.5	—	V
Viewing Angle	$\phi_1 \sim \phi_2$	$\theta=0^\circ$ $K=2.4$ *2	40	—	—	degree
	θ	$\phi=20^\circ$ $K=2.4$ *1	± 100	—	—	degree
Contrast Ratio	K	$T_a=25^\circ C$	*3	2.7	3.0	—
Response time rise	τ_r	$\phi=20^\circ C$	*4	—	300	400 ms
Response time fall	τ_d	$\theta=0^\circ C$	*4	—	300	400 ms

Measured on LCD only
Recommended controller LSI: HD61830B (Hitachi).

● Example for power supply circuit



● Interface Pin Function

Pin No.	Symbol	Function
1	D	Display data, H: light on L: light off
2	FLM	The FLM signal indicates the beginning of each display cycle.
3	M	Control signal for a.c. driving.
4	CL1	The CL1 latches the serial data in the shift registers.
5	CL2	Clock signal for shifting the serial data.
6	NC	—
7	V_{DD}	+5V (Power supply for logic)
8	V_{SS}	0V (Ground)
9	V_{EE}	12V (Power supply for LC driving)
10	V_0	Operating voltage for LC driving.

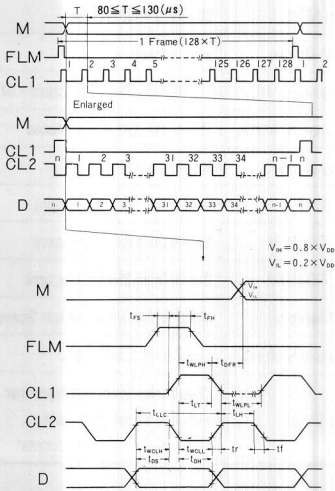
Pin No.	Symbol	Function
1	CFL GND	Power supply for Inverter "OUT GND" Terminal (Common)
2	CFL1	for Inverter "OUT1" Terminal
3	CFL2	for Inverter "OUT2" Terminal

● Interface Timing Chart

$V_{DD}-V_{SS}=5V\pm0.5V$

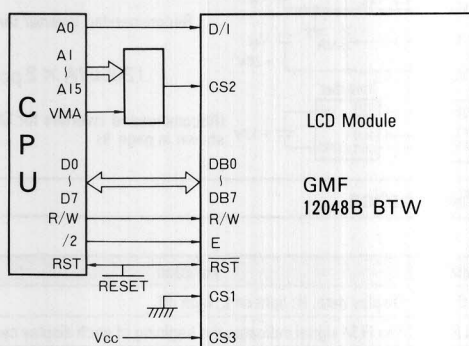
Item	Symbol	Min.	Typ.	Max.	Unit
Shift Clock frequency	t_{CLC}	—	—	6	MHz
Shift clock pulse width (H level)	t_{VCLH}	63	—	—	ns
Shift clock pulse width (L level)	t_{VCLL}	63	—	—	ns
Data set up time	t_{Ds}	50	—	—	ns
Data hold time	t_{DH}	30	—	—	ns
Latch pulse width (H level)	t_{VLPH}	110	—	—	ns
Latch pulse width (L level)	t_{VLPL}	220	—	—	ns
Latch timing time	t_{LT}	100	—	—	ns
Latch hold time	t_{LH}	0	—	—	ns
FLM signal delay time	t_{DFR}	-500	—	500	ns
"FLM" set up time	t_{Fs}	70	—	—	ns
"FLM" hold time	t_{Fh}	30	—	—	ns
Latch pulse time	T	80	100	130	μs
Input signal rise time	τ_r	—	—	*	
Input signal decay time	τ_d	—	—	*	

$$* \tau_r, \tau_d \leq \frac{t_{CLC} - t_{VCLH} - t_{VCLL}}{2} \quad \tau_r, \tau_d \leq 50 \text{ ns} \quad t_{CLC} = \frac{1}{f_{CLC}}$$

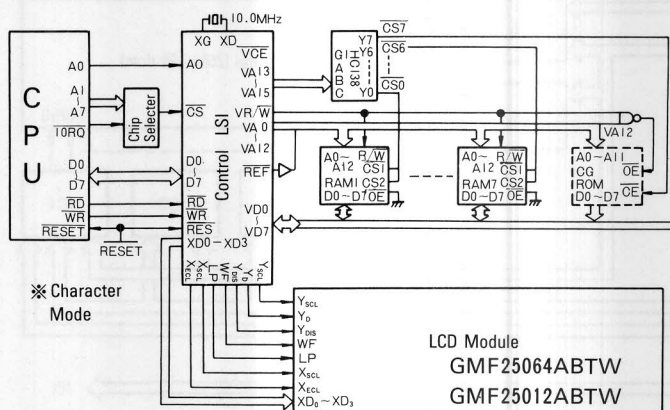


Example of system diagram

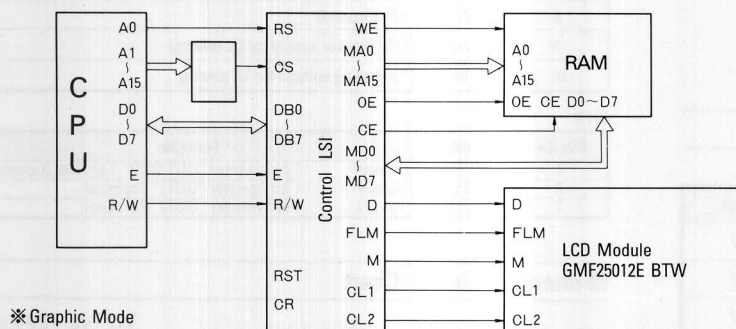
i) GMF12048B BTW



ii) GMF25064A BTW, GMF25012A BTW



iii) GMF25012E BTW



※ Graphic Mode

Note) Above Block Diagram shows an example of circuit.
Please refer to the specification of the control LSI to design the circuit.

Features of controller LSI

Graphic Dot Matrix Module GMF Series are to be interfaced with MPU through external control LSI. Representatives of Applicable control LSI are shown in the following table.
(Please ask us when you need the other specifications of controller LSI)

Item	E-1330 (SEIKO EPSON)	HD61830B (HITACHI)
Applicable Type No.	25064BTW/25012ABTW	25012EBTW
Display mode	Graphic mode	Graphic mode
	Character mode	
	Graphic/Character mixture mode	Character mode
Interface with MPU	80 system, 68 system	68 system
Data Bus to LCD Driver	4 bit parallel	Serial
Number of Dots	Character Mode 8×16 Dots-80 Characters×32 Lines	4096 Characters
	Graphic Mode 256×640 Dots×3 patterns	512k Dots
Operating Duty Ratio	Static ~ 1/256	Static ~ 1/128
Built-in CG ROM	5×7 Dots 160 characters	5×7 Dots 160 characters+5×11 Dots 32 characters
External	CG RAM 8×16 Dots 64 Characters	—
	CG ROM 8×16 Dots 256 characters	8 × 16 dots 256 Characters
Frame Buffer Memory	64KB MAX. Imagination Screen System	—
Special Function	Automatic Cursor Shifting	Up, Down, Left, Right.
	Flexible Scroll	
	Display in Graphic/Character Flexible Scroll of Cursor Smooth Scroll to Horizontal	

PRECAUTIONS FOR USAGE

1. HANDLING

- (1) Do not touch, press or rub the display panel with a hard tool or object such as tweezers as the polarizers in the panel are easily scratched.
- (2) Do not use organic solvents to clean the display panel off as these solvents may be adverse to polarizer. To clean the surface off, dried cloth, dampened absorbent cotton with petroleum benzine or adhesive tape are preferable.
- (3) Do not touch electrode terminals of P.C.B. or LSI leads.
- (4) Avoid using or storing the module under the conditions of high temperature and high humidity. when stored, this module should be packaged in a conductive polyethylene bag and placed under the certain condition where the temperature is relatively low (5-30°). The direct sunlight or fluorescent lamp must be shut off.

2. OPERATING

- (1) Do not connect or disconnect the module to or from main system while power is being supplied.
- (2) Use the Module within specified temperature; otherwise it causes, the retardation of blinking speed of the display below specified temperature and causes the display to get dark above specified temperature.
- (3) Adjust the LC driving voltage (VEE) so that the display shows optimum contrast.

3. WORKING CAUTIONS

- (1) Use a grounded soldering iron when connector terminals are soldered.
- (2) Do not disassemble. In case that, after disassembling, the module doesn't work due to failure of reassembly, it is not our responsibility.
- (3) Care should be taken not to charge static electricity, as the circuit of this module contains CMOS LSIs. A workman's body should be grounded with an earth band. The material which prevents static electricity should be selected for a working cloth.

■ APPEARANCE LIMITATION (LCD) For GMD Series

Regulations of the following items that appear in the effective display area

(1) Black spots, foreign articles, pinhole, white spots.

Diameter D (mm)	Numbers
$D \leq 0.15$	No Count
$0.15 < D \leq 0.20$	$N \leq 2$
$0.20 < D$	$N = 0$

(2) White line, black line, scratch

Width W (mm)	Length L (mm)	Numbers
$W \leq 0.03$	$L \leq 0.5$	No Count
$0.03 < W \leq 0.05$	$0.5 < L \leq 2.0$	$N \leq 3$
$0.05 < W$	$2.0 < L$	$N = 0$

(3) Bubbles of polarizer

Diameter D (mm)	Numbers
$D \leq 0.5$	No Count
$0.5 < D \leq 1.0$	$N \leq 3$
$1.0 < D$	$N = 0$

(4) Line, scratch of polarizer

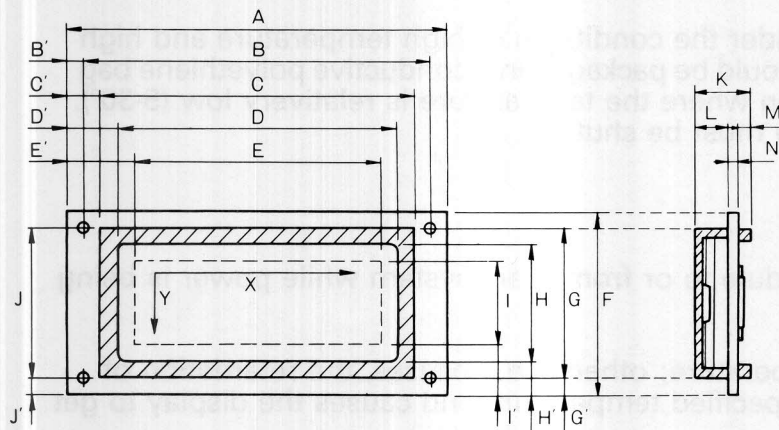
Width W (mm)	Length L (mm)	Numbers
$W \leq 0.3$	—	No Count
$0.3 < W \leq 1.0$	$L \leq 5.0$ $5.0 < L \leq 10.0$ $10.0 < L$	No Count $N \leq 2$ $N = 0$
$1.0 < W$	—	$N = 0$

(5) Bruise of both sides of polarizer No more than 2 pcs. ($D \leq 0.3$)

Custom Dot Matrix Order Check Sheet

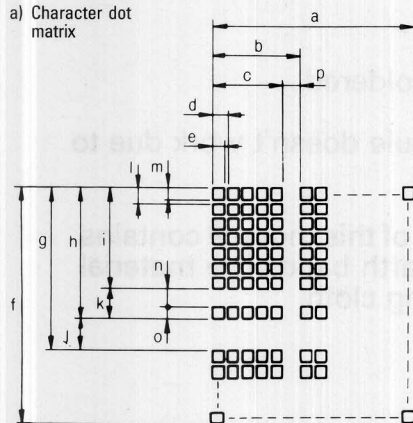
Stanley can accommodate in designing and producing custom dot matrix module to meet customers applications and requirements.

▼ Dimensions and display pattern



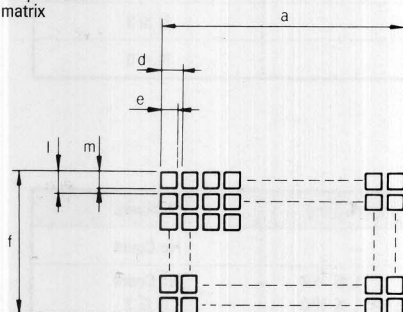
Item	Symbol	Dimensions
Outer dimension	$A \times F \times K$	
Bezel size	$C \times G$	
Bezel opening	$D \times H$	
Active area	$E \times I$	
Mounting hole location	$B' \times J'$	
Mounting hole size	O	
thickness of PCB	N	
Others	C'	
	D'	
	E'	
	H'	
	J	
	L	
	M	

a) Character dot matrix



Character dot matrix () characters \times () lines		5 \times 7 dots
		5 \times 11 dots
		Others ()
		Cursor
Graphic dot matrix	Horizontal	() dots
	Vertical	() dots
Annunciators Please indicate individual annunciators and numerics.		

b) Graphic dot matrix

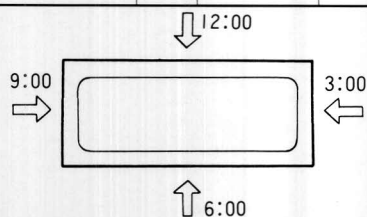


Item	Symbol	Dimensions
Active area	$a \times f$	
Dot size	$e \times m$	
Dot pitch	$d \times l$	
Character size	$c \times i$	
Character pitch	$b \times g$	
Cursor height	o	
Others	h	
	j	
	k	
	n	
	p	

Note:
 (1) Bezel opening shall be smaller than effective viewing area of LCD cell.
 (2) Bezel width ($\frac{C-D}{2}$, $\frac{G-H}{2}$) shall be wide enough to cover terminal area and seal area.
 (3) Minimum space between dots is 0.04 mm.

▼ LCD type

LCD mode	Display mode	Viewing direction
DST positive	Reflective	6 O'clock
DST negative	Transflective	12 O'clock
FST positive	Transmissive	Others ()
STN yellow-mode	Reflective	6 O'clock
STN blue-mode	Transflective	12 O'clock
STN gray-mode	Transmissive	Others ()



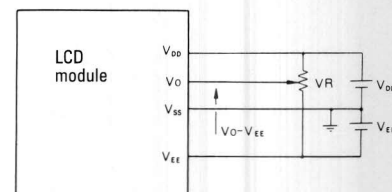
*Note) DST LCD uses the color rectifying STN panel to produce a high-contrast black and white display.
FST LCD uses the polymer film to produce a high-contrast black and white display.

▼ Backlighting

Backlight source	Lighting method	Backlight color
EL	Backlighting	Blue green
		White
CFL	Backlighting	White
	Edgelighting	White
LED	Backlighting	Green
	Edgelighting	Orange
		Yellow
		Red
Incandescent	Backlighting	
	Edgelighting	

▼ Operating conditions

Operating temperature range	T_{opr}	°C to	°C
Storage temperature range	T_{stg}	°C to	°C
Power supply for logic	V_{DD}		V
GND	V_{SS}	0	V
Power supply for LCD	V_{EE}		V
Supply voltage for LCD driver	V_0	V to	V
Supply voltage for backlight	V_{LP}		V

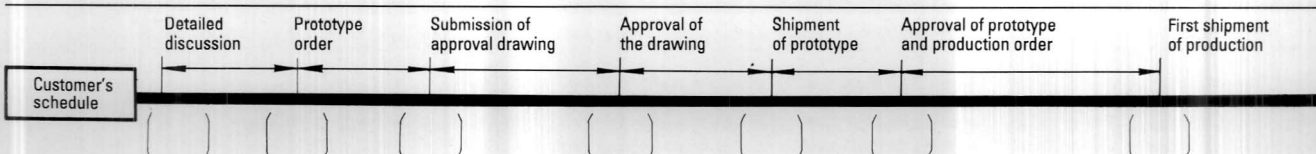


	Dot matrix		Annunciators	
Duty cycle		duty cycle	Static, Multiplex: /	duty cycle
Driver LSI	Common	, pcs	pcs	
	Segment	, pcs		
Control LSI		built-in, external		
Interface with CPU				

● For quotation

- Total quantity _____ per order
- Application _____
- Target price _____
- Competition _____
- Required date for quotation _____
- per month _____ per year

● Schedule





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